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CONTENTS

DEPARTMENTS

For complete table of contents see advertising page V

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AMERICAN JOURNAL OF OPHTHALMOLOGY

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THE REACTION OF THE RABBIT EYE TO NORMAL HORSE SERUM*

SENSITIZATION BY INTRADERMAL INJECTION

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A close resemblance of the microscopic picture of sympathetic ophthalmitis has been produced by the use of normal horse serum. Inflammation did not develop in the sympathizing eyes, but most of the histologic characteristics were obtained in the injected eyes.

The decision to use normal horse serum in this experimental study was based on the following factors:

1. It has been postulated that a nonspecific stimulus when introduced through an ocular perforation may awaken the unknown etiologic mechanism of sympathetic ophthalmitis,[1] perhaps by causing the melanophores to release their pigment.

2. The studies of Doan, Sabin, and Forkner[2] have shown that it is the lipoids in tubercle bacilli that instigate the production of the tubercular type of granulation tissue. Since blood has been known to incite the production of tubercular granulation tissue, and since normal horse serum contains various lipoids, it was logical to assume that horse serum might induce a tubercular type of histologic picture similar to that of sympathetic ophthalmitis.

3. Burky,[3] Seegal and Seegal,[4] and others have shown that horse serum may be used to produce inflammation in rabbit eyes.

Burky sensitized rabbits by making repeated intracutaneous injections and then filled the anterior chambers with a foreign protein by alternate aspiration of the aqueous humor and injection of foreign protein.[3]

We were interested in the results that would follow if the injections were made through that danger zone for sympathetic ophthalmitis, the ciliary body.

4. We wished to repeat the work of Lucic, using a simplified method and a nonbacterial allergen. Lucic has produced experimentally a close resemblance to the histopathologic picture of sympathetic ophthalmitis.[5] He sensitized rabbits by means of repeated intracutaneous injections of what he has called "staphylodiphtheroid antigen." This "antigen" consists roughly of a 48-hour beef-hormone bouillon culture of diphtheroid bacilli incubated with a toxin-producing staphylococcus for eight days at 37°C. The "staphylotoxin" was used to sensitize the rabbits to the diphtheroid bacilli.

Lucic tried different methods to obtain an appreciable reaction. His best results were obtained by sensitizing the animals as already described, and then injecting two heavy suspensions of Bacillus hoffmanni in physiologic saline into the right eye, the first injection into the ciliary body, and the second, 10 days later, into the vitreous. A similar injection was then given intravenously in 7 days. Ten days

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later an injection was made into the left common carotid artery. Although this method achieved results, and in both eyes, it is complicated, and it does not rule out the possibility that the results were due to bacterial action as well as to allergy. It was felt that a similar but simplified procedure, in which a nonbacterial allergen was used, if it were successful, would show more definitely that the phenomenon was an allergic one. Therefore, we used normal horse serum and a modification of the method of Burky.

Two series of rabbits were used. In the first series the rabbits were sensitized by intradermal injections before being injected in the right eye, whereas in the control group the rabbits were injected without having been previously sensitized.

Experiment

The first series consisted of 22 pigmented rabbits. Into a shaved back area four intradermal injections were made. One-tenth cubic centimeter of normal horse serum with 1:10,000 merthiolate (Lilly) was used for each of these four injections. At weekly intervals these injections were repeated until necrotic centers appeared in the wheals (Arthus phenomenon) or until four or five weekly doses had been given. Such wheal reactions were considered indicative of maximum sensitivity. Most of the rabbits developed necrotic centers after the third weekly set of injections. Microscopic study of a quiescent necrotic-centered wheal revealed, besides a necrotic region, an infiltration of large mononuclear cells and a few nodules of epithelioid-like cells. The infiltration of the skin was much like that in the eye except that we found no giant cells in the two skin sections studied. There was no correlation between the development of dermal necrosis and the ocular reaction later.

When the skin reactions were at their maximum, the next injection of 0.1 c.c. was made into the ciliary body and vitreous of the right eye the following week. The right eyes were anesthetized by three applications of two drops of 4-percent butyn. The conjunctiva was grasped with toothed forceps, while a 27-gauge needle was inserted 5 mm. behind the limbus at the 12-o'clock meridian. The injection was made into the vitreous as near to the ciliary body as possible. At the same time a 0.1-c.c. intradermal test dose was used to establish the existing degree of sensitivity. We found no close correlation between the severity of the skin reactions and the ocular reactions, although they both tended to be pronounced.

Ten of the 22 rabbits died, during sensitization, of intercurrent infection not connected with the procedures. Of the remaining 12 rabbits, 7 (group A) were treated as described; 3 rabbits (group B) received a second 0.1-c.c. intraocular injection at the 12-o'clock meridian one week later; whereas 2 rabbits (group C) received their intraocular horse serum with finely divided, autoclaved carbon particles suspended in it.

The rabbits were killed and their eyes enucleated after variable periods ranging from one-half day to 28 days.

In every case the degree of ocular reaction was severe and was read as either three or four plus (see footnote, table 1). There was intense chemosis and congestion of the conjunctivas, which elevated them as much as a centimeter. The pupils were small and sluggish, or fixed to light stimulation; the irides were muddy; and a plastic exudate frequently was seen over iris and pupil. Such ocular reactions were well developed in 24 hours and lasted for over a week.

Histopathology

Microscopic study showed that the first infiltration seen at the end of one-half day

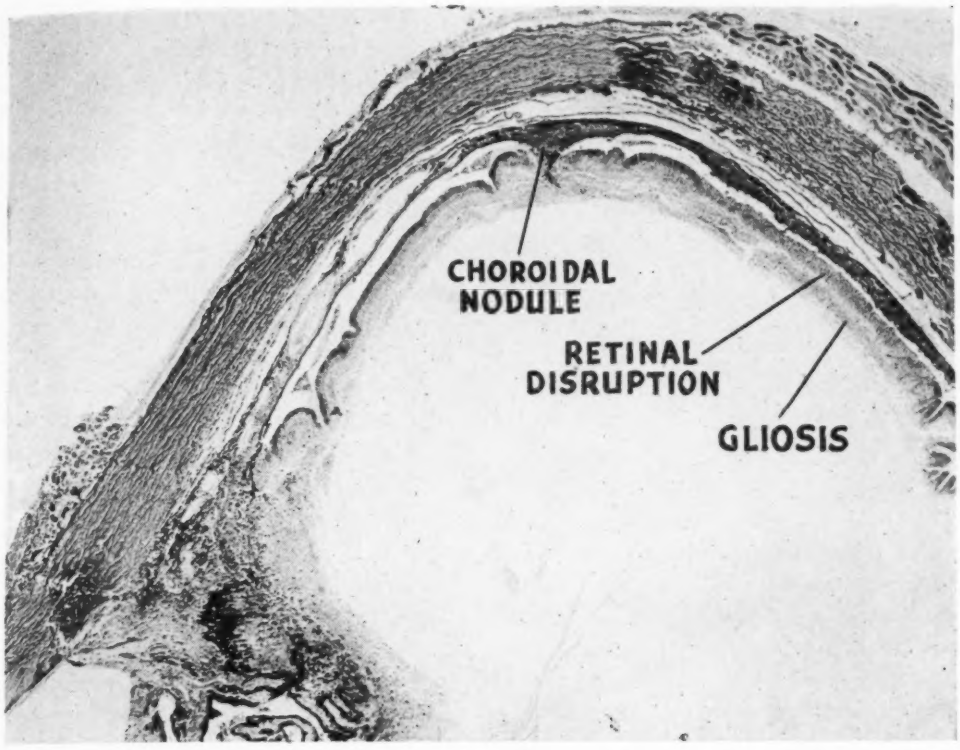

Fig. 1 (Schlaegel and Davis). The choroid is infiltrated with mononuclear cells which form nodular aggregates. The retina shows disruption of detail in some areas, with gliosis on its internal surface.

was composed solely of polymorphonuclear leucocytes, but after an interval of one whole day the infiltration consisted of mononuclear cells in such numbers that they slightly outnumbered the polymorphonuclear cells. After seven days no polymorphonuclears were seen except for an occasional eosinophil.

It has long been known that, in the early stages of most types of acute inflammation, the polymorphonuclear cells predominate, and that with the passing of time the mononuclears increase and eventually may outnumber the polymorphonuclear cells. Menkin has shown that when the pH of the exudate is alkaline, the percentage of polymorphonuclears exceeds that of the mononuclears.[6] When the pH reaches the acid side, the mononuclear cells become dominant. The pH of the normal horse serum, measured by means of the glass electrode, was 7.74. This may be one reason why the first infiltration was composed entirely of polymorphonuclears. Samuels has pointed out that it is almost impossible by any form of irritation to cause pus cells to be poured out into a rabbit's choroid.[7] However, we found the pH of the rabbit vitreous to be 7.40 within three minutes after a freshly enucleated eye had been opened. (The reaction rapidly becomes more alkaline on exposure to air.) Thus it is theoretically probable that all infiltrations in rabbits' eyes would show an initial polymorphonuclear dominance if they were examined early enough.

The most striking involvement of the right eyes of the animals in series 1 was the massive mononuclear infiltration of

the uvea. The classification of most of the sections as three or four plus was used arbitrarily to indicate an infiltration of the choroid sufficient to bulge it in places at least to the thickness of the retina (fig. 1) and to indicate the presence of multinucleated giant cells.

There was no close correlation between the gross living appearance and the microscopic reaction except that they both tended to be pronounced.

COMPARISON WITH SYMPATHETIC OPHTHALMITIS

To facilitate description of the histopathologic picture obtained in series 1, and to aid in comparing the various features thereof with those of sympathetic ophthalmitis, we will list as *pro* or *contra* those features obtained that are like or different from those of sympathetic ophthalmitis. Duke-Elder's textbook[8] was our principal authority for the accepted histopathology.

IRIS: *Pro.* All but two of the eyes showed an infiltration into the posterior half of the iris consisting mainly of plasma cells.

Contra. The infiltration was not nodular and massive and did not contain epithelioid-like cells or giant cells.

CILIARY BODY: *Pro.* 1. The ciliary body was definitely infiltrated in practically every case. 2. The infiltration first involved the portion of the ciliary body lying internal to the ciliary muscle and later the entire ciliary body. 3. The cells were lymphocytes, plasma cells, giant cells, and epithelioid-like cells. 4. The infiltration was not uniformly more pronounced at the site of injection.

Contra. There was also a large number of large mononuclear cells or monocytes in the infiltration.

CHOROID: *Pro.* 1. It was the site of the most intense cellular infiltration. 2. It usually was overrun by a dense infiltra-

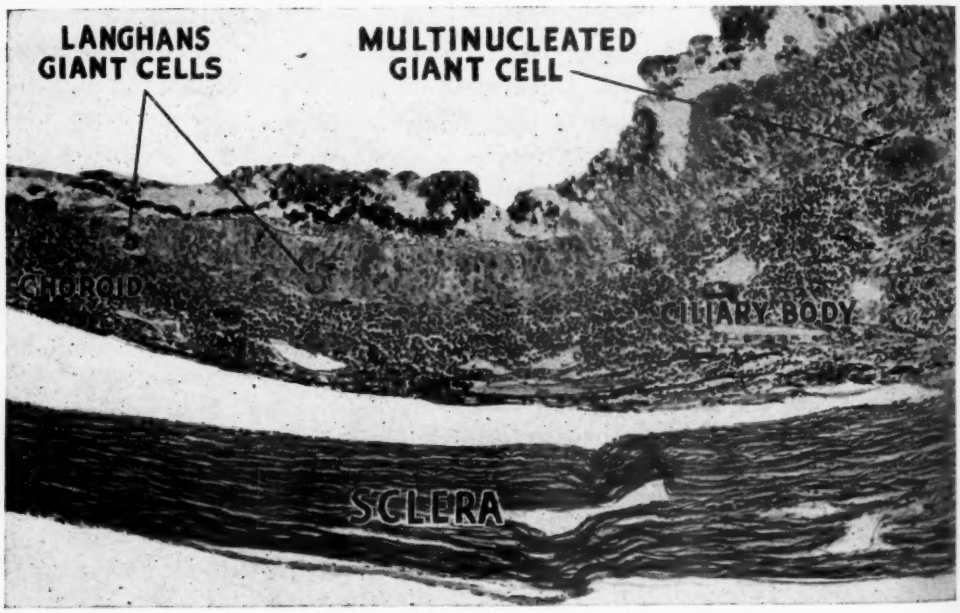

Fig. 2 (Schlaegel and Davis). The internal layers of the choroid and ciliary body are composed predominantly of epithelioid-like cells with two giant cells of the Langhans type and one of the foreign-body type.

tion either in the form of nodules or as a continuous sheet of wandering cells accentuated at points by nodules. The cells were, as in the ciliary body; namely, lymphocytes, plasma cells, epithelioid-like cells, large mononuclears, and multinucleated giant cells. 3. Most of the giant cells were of the epithelioid or Langhans type, although many were of the foreign-body type. 4. Epithelioid-like and giant cells contained phagocytosed pigment granules to a variable degree. 5. The choriocapillaris was relatively free of infiltration.

Contra. 1. There was no early perivascular infiltration of the choroidal vessels. 2. The epithelioid-like cells were often not grouped in nodular aggregates, but as large fusiform areas in the inner part of the choroid (fig. 2) or between the choroid and retina.

DISCUSSION: The plasma cells were numerous and constituted about one third of the large mononuclears. Eosinophilic polymorphonuclears were occasionally seen, sometimes in groups. Edema and congestion of the uvea, occasional hemorrhage, and necrotic areas were seen in varying degree.

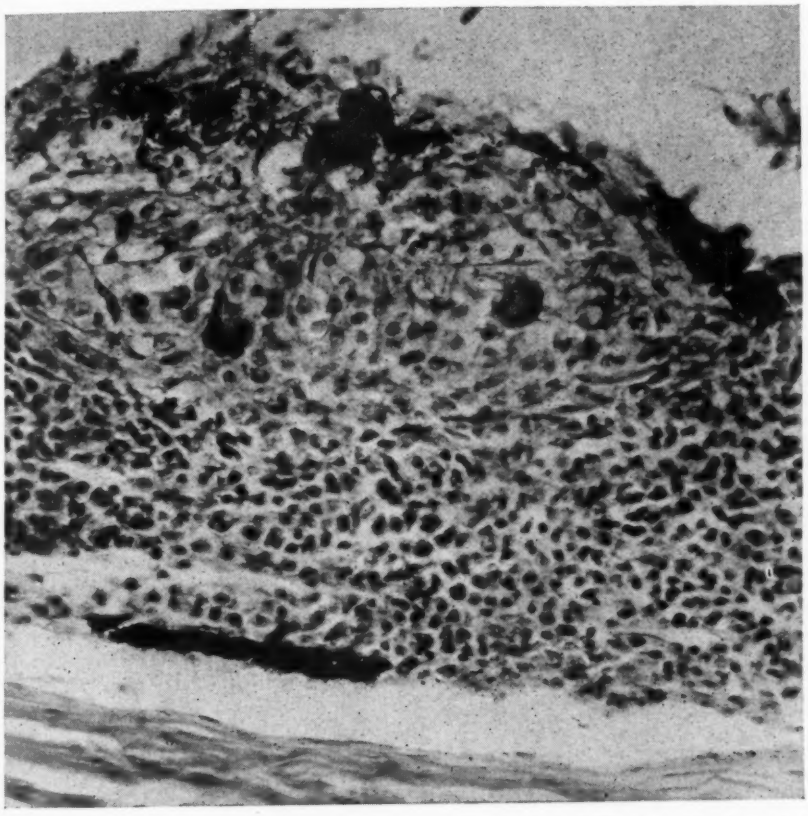

Fig. 3 (Schlaegel and Davis). A lenticular aggregate of epithelioid-like cells with two small giant cells located in the choroid.

We have used the term epithelioid-like because there is much confusion in the definition of epithelioid cells, and because we do not have proof by supravital staining. These cells had large pale nuclei about 12 micra in diameter; a definite and

fairly heavy nuclear membrane; a prominent nucleolus, often with smaller chromatin clumps; a nucleus that was usually round but often elongated, irregular, tapering and bent upon itself; and a light eosinophilic, indistinct but usually fusiform cytoplasm.

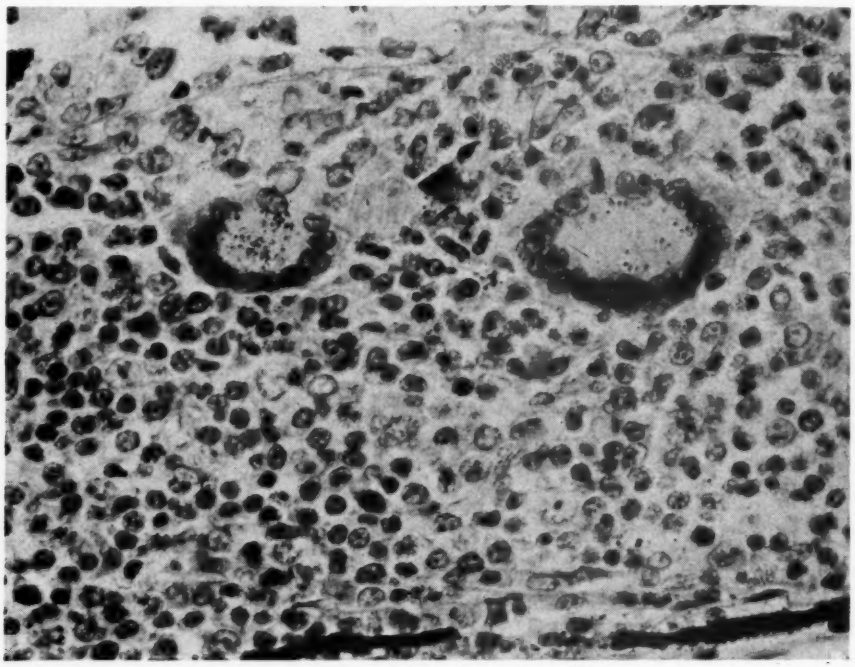

Fig. 4 (Schlaegel and Davis). Region in the choroid showing two giant cells with englobed melanin clumps surrounded by a few epithelioid-like cells but no definite nodule.

Giant cells were seen in the centers of some of the lightly stained areas made up of epithelioid-like cells (fig. 3). Giant cells were also seen lying over the optic disc or corona ciliaris, or imbedded in the infiltration of the uvea without an accompanying nodule of epithelioid-like cells (fig. 4). They were found in all but one of the positive sections after seven days. One plus is used to indicate the presence of 1 or 2 giant cells in the routine six sections that were made, whereas two plus indicates 3 to 10 giant cells. The number of these multinucleated cells obtained is definitely less than is often seen in sympathetic ophthalmitis, but some authorities do not require their presence as a criterion for diagnosis.

It has been pointed out that both the epithelioid type and the foreign-body type of giant cells always arise as a response to the need for phagocytosis of foreign material.[9] Although the common factor stimulating their production is yet unknown, it is known that the stimulus for the formation of the giant cells of the foreign-body type are much more varied than those which produce the epithelioid cells and ultimately the Langhans type of giant cells.

SCLERA: *Pro.* The scleras were involved in two of the strong reactors of this series. This involvement was an infiltration of lymphocytes and large mononuclears in

the outer portion of either the anterior or posterior segments. Slight perivascular infiltration around vessels in the sclera was seen (fig. 5).

The extraocular tissues were commonly found involved by a mononuclear infiltration.

Samuels has drawn our attention to the severity of scleral involvement in sympathetic ophthalmitis.[10] He found a higher percentage and a more severe degree of infiltration than we obtaind. However, since involvement of the sclera in man is proportional to the degree of uveal infiltration, we, too, probably would have obtained more scleral involvement if our uveal reaction had been as massive as it often is in sympathetic ophthalmitis.

Contra. Among the infiltrating cells of the sclera, there was an absence of giant cells and epithelioid-like cells, which are often present, but not invariably so, in cases of sympathetic ophthalmia.

RETINA: *Pro.* Cellular infiltration was strikingly absent except for a slight invasion of epithelioid-like cells at some places where the retina and choroid were adherent.

Contra. Although the retinas were not so involved as were the uveas, careful examination revealed a number of changes in 7 of the 12 right eyes of series 1. This involvement varied from adhesions of the retina to itself and to the choroid, to a massive gliosis as thick as the retina itself lying on its internal surface (fig. 6). This gliosis apparently was due to a proliferation of astrocyte-type cells from the retina, and the stimulation for their proliferation was probably the specific nervous-tissue degeneration of the retina.[11]

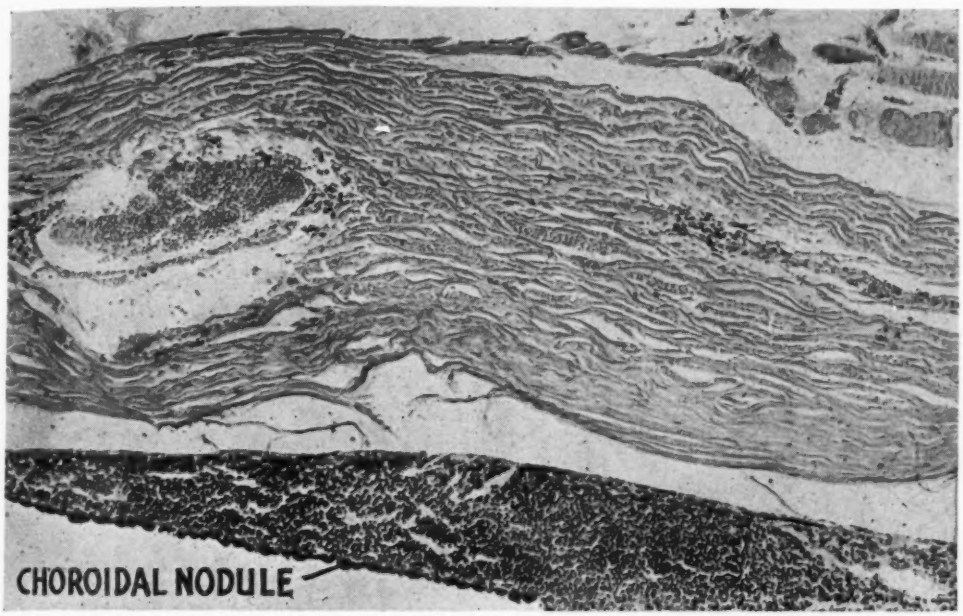

Fig. 5 (Schlaegel and Davis). Slight perivascular infiltration of a large vessel cut in cross section and a small one cut longitudinally. This scleral infiltration is adjacent to a choroidal nodule.

In a discussion of the pitfalls encountered in experimental attempts to produce sympathetic ophthalmitis, Samuels has said: "There never can be any ground

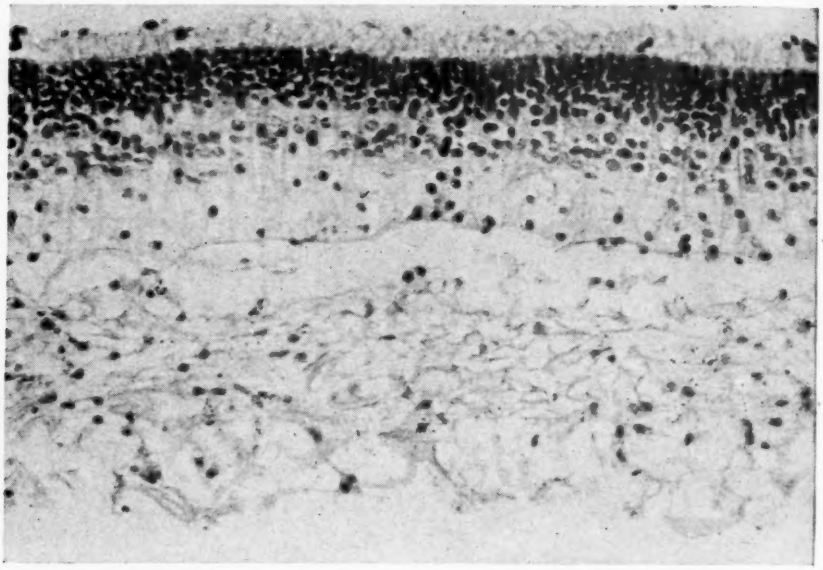

Fig. 6 (Schlaegel and Davis). There is gliosis on the internal surface of the retina as thick as the retina itself.

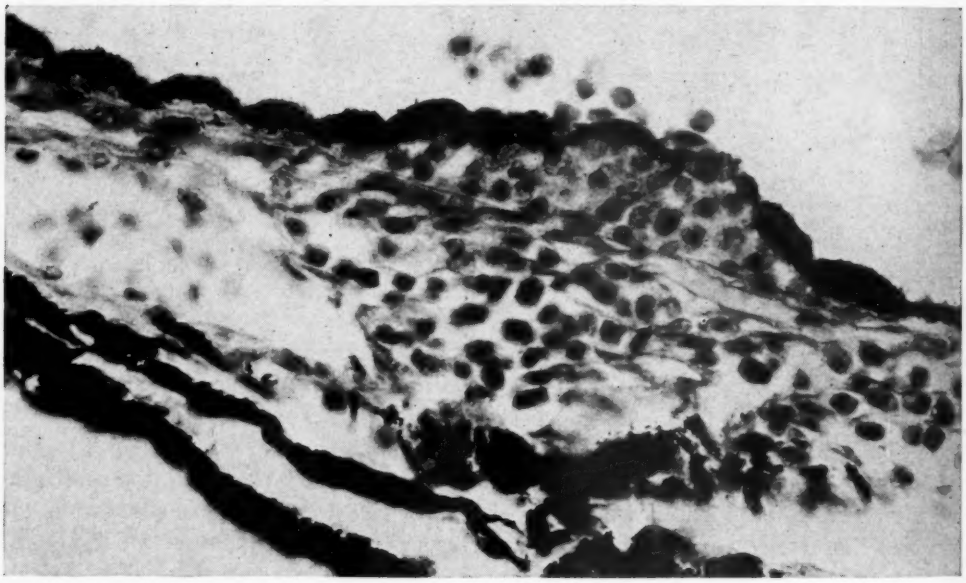

Fig. 7 (Schlaegel and Davis). This nodule is composed of mononuclear cells over Bruch's membrane and under the pigment epithelium. The adjacent pigment epithelium is swollen and scalloped.

for discussion as to similarity to sympathetic ophthalmitis if after an injection into the vitreous of a rabbit the retina becomes necrotic, because an infiltration so produced has an absolutely different meaning from that of sympathetic ophthalmitis. It belongs to the realm of panophthalmitis and is the result of a toxic

influence exerted on the choroid."[7] It must be admitted that 7 of the 12 eyes showed some necrosis of the retina which resulted in a loss of definition in some areas. However, we feel that what we obtained was not panophthalmitis because: 1. The scleras were relatively uninvolved. 2. The retinas were infiltrated only by epithelioid-like cells. 3. The choroid was the most involved part of the uvea. 4. None of the eyes developed a purulent inflammation.

The allergic reaction to the horse serum may be sufficient to explain the necrosis.

No perivascular infiltration was seen in the retinas.

PIGMENT EPITHELIUM: *Pro.* 1. There was frequently a general disintegration of the pigment associated with infiltration from the choroid. 2. The cells of the pigment epithelium were swollen. Their inner, or vitreous, faces were ballooned into hemispheres giving the layer of cells a scalloped surface. Although the cells were increased in size, they appeared to be as darkly pigmented as normal cells. 3. In many places mononuclear cells were seen

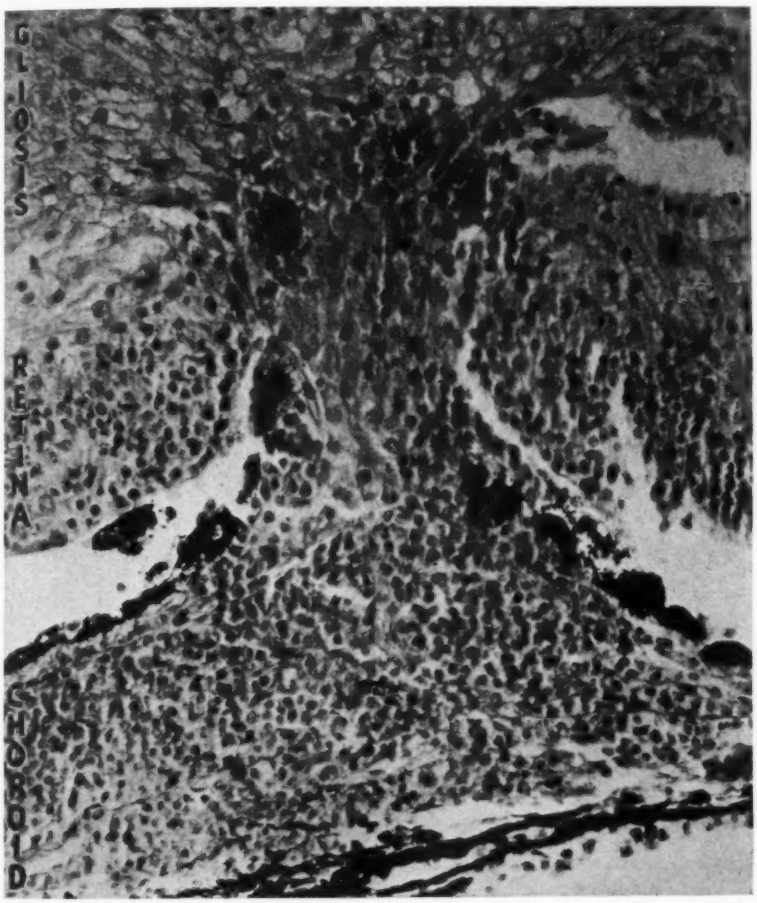

Fig. 8 (Schlaegel and Davis). The choroid has bulged inward, becoming adherent to the retina and allowing the escape of epithelioid-like cells into the retina.

lying over Bruch's glass membrane and under the pigment epithelium, raising it to form nodules (fig. 7). 4. Epithelioid-like cells were seen occasionally to push up the pigment epithelium and break

OPTIC NERVE: *Pro.* Infiltration in the nerve and in its meninges near the globe was seen occasionally (fig. 9).

VITREOUS BODY. Most of the sections

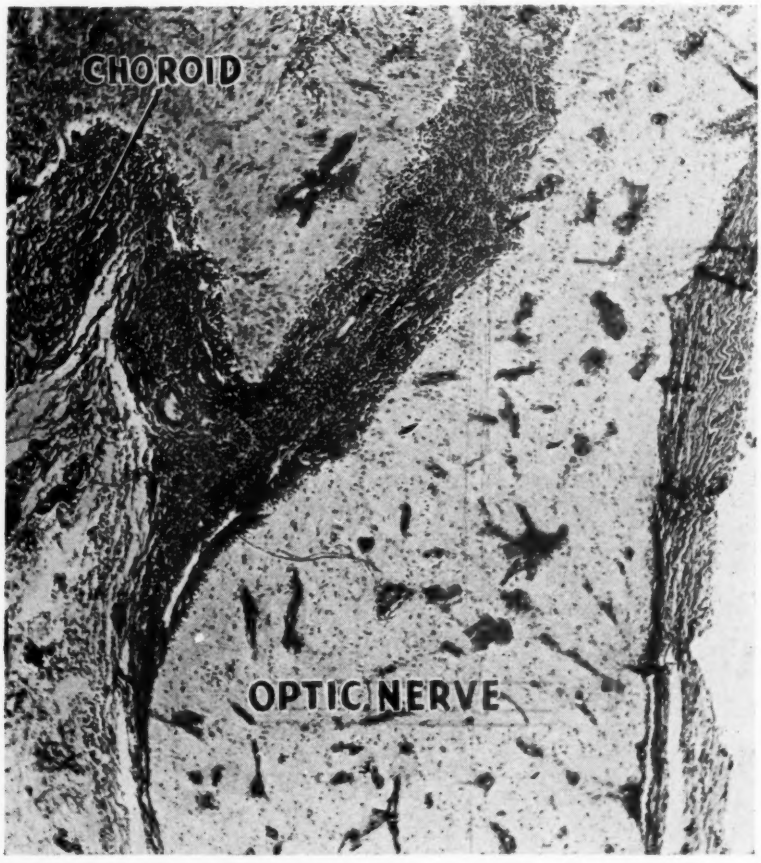

Fig. 9 (Schlaegel and Davis). The optic nerve and its sheaths (longitudinal section) are infiltrated by extension from the choroid.

through into the subretinal space or into the retina (fig. 8).

These features resemble the development of the Dalén-Fuchs nodules, which are characteristic of sympathetic ophthalmitis.[12]

Contra. Although the pigment epithelial cells were seen to swell, no definite proliferation was noted in the production of nodules.

showed macrophages and plasma cells scattered in the vitreous over the corona ciliaris.

CORNEA. No involvement was observed except for a slight mononuclear infiltration at the limbus.

The infiltration in group B, in which the rabbits received a re-injection in their right eyes, was not more severe than in

group A, which received only one eye injection.

In group C the carbon in the horse serum did not increase the degree of cellular infiltration. There was, however, a great increase in large macrophages around the carbon particles, but the degree of phagocytosis was no greater than trauma of injection. Three rabbits which showed a more severe reaction at this time failed to show a more severe microscopic infiltration. This objective reaction was attributed to excessive trauma in injecting. However, two rabbits (P609 and P559) showed a pronounced objective reaction after two weeks had elapsed,

TABLE 1

SERIES 1. GROSS LIVING AND MICROSCOPIC RESULTS OF THE INJECTION OF NORMAL HORSE SERUM THROUGH THE CILIARY REGION OF THE RIGHT EYE AFTER SENSITIZATION BY INTRADERMAL INJECTION

Rabbit Number		Gross Reaction (24–48 hrs.)*		Days from Intraocular Injection till Enucleation	Microscopic Study		
					Right Eye		Left Eye
		O.D.	O.S.		Degree of Infiltration	Giant Cells	
Group A	P605	+++	0	½	1+	0	normal
	P456	+++	0	1	1+	0	normal
	P764	++++	0	7	4+	2+	normal
	P521	++++	0	14	3+	1+	normal
	P505	++++	0	21	3+	1+	normal
	P509	++++	0	21	normal in 22 sections		normal
	P535	+++	0	21	3+	1+	normal
Group B	P502	+++	0	21†	1+	0	normal
	P568	+++	0	21†	2+	1+	normal
	P504	++++	0	28†	3+	2+	normal
Group C	P503	+++	0	14	3+	2+	normal
	P510	+++	0	21	2+	2+	normal

*+ = slight objective change as sluggish pupillary response or slight congestion at the injection site.
++ = moderate congestion and chemosis and slight uveitis.
+++ = pronounced congestion and chemosis, more uveitis.
++++ = extreme congestion and chemosis, strands of exudate on iris and in pupil.
0 = no change in eye.
† = re-injected into the right eye seven days after the first injection. These figures indicate the total days elapsed from the first injection till enucleation.

in the control. Thus these macrophages seemed to have been called out primarily in response to the particulate matter and not in response to the allergic reaction, which was greater in series 1 than in the control.

CONTROL

The rabbits of the control series received intraocular horse serum without previous sensitization by intradermal injection. Most of the animals showed only a slight objective reaction in 24 to 48 hours, such as might be expected from the and this flare-up was confirmed by a more pronounced microscopic cellular infiltration. Such a response in an eye after 14 days has been noted by other observers, such as Wessely,[13] Seegal and Seegal,[4] and Riehm.[15] To this observation of an occasional reaction in some rabbits after 14 days, we have added the finding of a constant microscopic infiltration in all our rabbits after 14 days whether or not they showed a gross living reaction, although the cellular reaction was more marked if the gross reaction was violent.

We may thus conclude that the reaction seen in the eyes in the first day or two after injection is probably due to trauma. But the reaction which develops after two weeks and results in definite cellular infiltration is possibly an allergic manifestation due, perhaps, to an antigen-antibody complex.

The cellular infiltration of the control group, although delayed 14 days and less that in both series the infiltration was due to the stimulus afforded by one or more of the degradation products of the horse serum. This belief is based on the following considerations and reasoning:

1. a. Some lipoids, especially phospholipids, are capable of stimulating the production of tubercular granulation tissue. b. Normal horse serum contains various lipoids including phospholipids.

TABLE 2

CONTROL. GROSS LIVING AND MICROSCOPIC RESULTS OF THE INJECTION OF NORMAL HORSE SERUM INTO THE RIGHT EYE OF EACH OF TWELVE NORMAL, NONSENSITIZED RABBITS

Rabbit Number		Gross Reaction (24–48 hrs.)*		Days from Intraocular Injection till Enucleation	Microscopic Study		
					Right Eye		Left Eye
P=pigmented A=albino		O.D.	O.S.		Degree of Infiltration	Giant Cells	
Group A	P533	+	0	½	Normal		Not done
	P762	+	0	1	Normal		Not done
	P737	+	0	2	Normal		Not done
	P788	+	0	7	Normal		Not done
	A603	+++	0	14	2+	0	Not done
	P606	+	0	14	2+	0	Not done
	P565	+	0	21	1+	0	Not done
	P609	+	0	21	4+	1+	Not done
Group B	P727	+	0	21‡	3+	2+	Not done
	P777	++†	0	28‡	1+	0	Not done
Group C	P800	++++†	0	14	1+	0	Not done
	P559	+	0	21	2+	1+	Not done

* Cf. Table 1.
† Struggle of rabbits caused trauma and re-injection was necessary.
‡ Re-injected in the right eye seven days after the first intraocular injection. This figure indicates the total time elapsed from the first injection till enucleation.

severe, is so like that observed in series 1 that it needs no description.

In every case in both series the left or sympathizing eye failed to show signs of reaction by the time of enucleation, which ranged up to four weeks. Since the left eyes of series 1, which were considered the ones most likely to show a sympathizing reaction, were found to be uniformly normal by microscopic study, the left eyes of the controls were not studied.

COMMENT

We believe that the evidence indicates

Therefore, it is possible that the tubercular type of cellular reaction obtained was due to the normal horse serum or one of its components.

2. a. The eyes in both series of animals were injected in exactly the same manner with the same lot of serum. b. But the cellular infiltration appeared within 12 hours in series 1 as compared to 14 days in the control.

Therefore, some change probably occurred in the horse serum in the eyes of rabbits of series 1, making it capable of inciting cellular infiltration before the

normal or control period of 14 days.

3. a. Many of the lipoids in normal horse serum are known to be conjugated with protein.

Therefore, it is probable that some breakdown of the horse serum is necessary to liberate the active agent or agents. And it appears that the allergic reaction manifested by the eyes of series 1 is the logical condition capable of accounting for this breakdown.

It was not a main purpose of this experiment to create a sympathizing inflammation but rather to induce an inflammation by allergic means and to compare the histologic results with those found in sympathetic ophthalmitis. The allergen that was used is not a pure protein, for normal horse serum is a complex substance, containing, among other things, various lipoids. Further work will be necessary to determine what specific factors in normal horse serum are responsible for the allergic reaction and what factors produce the cellular infiltration.

Riehm has obtained a sympathizing inflammation in the eyes of rabbits by using horse serum.[14, 15] He does not describe his procedures clearly and completely, but they appear to be complicated and to involve massive doses of horse serum given intravenously. We tried to keep this experiment as simple as possible and to rule out the role of bacterial action in the histologic results obtained by Lucic.

The microscopic results that we obtained were striking and uniform, and compare favorably with the results observed by Lucic when using his "staphylodiphtheroid antigen." Lucic[5] obtained many epithelioid and giant cells with much phagocytosed pigment. Our sections did not show as intense pigment phagocytosis nor as many epithelioid and giant cells. Also, none of our rabbits developed a sympathizing inflammation as did some of Lucic's. However, Lucic apparently got a retinal infiltration and had a number of rabbits which developed purulent endophthalmitis.

It is difficult to compare our microscopic results with those of other experimenters because of the brevity of their reports. Neither Lucic's work nor this work has duplicated exactly the histopathologic picture of sympathetic ophthalmitis. Although we observed most of the features, there were two definite variations: 1. the high percentage of large mononuclear cells; 2. the distortion, gliosis, and necrosis of the retina.

Summary

1. Signs of uveitis were seen after 24 hours in the right eye of every rabbit previously sensitized by intradermal injection but were absent almost uniformly from the eyes of the control group.

2. The uvea was the most involved membrane. It was infiltrated with lymphocytes, multinucleated giant cells, epithelioid-like cells, large mononuclears, and plasma cells.

3. On the internal surface of the retina there developed an astrocyte type of gliosis that produced an additional inner layer almost as thick as the retina itself.

4. Cellular infiltration in the control animals was less intense but of the same type as in those of series 1. It did not appear until 14 days had elapsed, but was constant thereafter.

Conclusions

1. The histopathologic results of "staphylodiphtheroid antigen" have been duplicated roughly by using normal horse serum.

2. The microscopic picture obtained in the eyes injected with normal horse serum bears a close resemblance to that of sympathetic ophthalmitis.

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RETROILLUMINATION

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Transillumination of the eye is of little use unless the tumor is located far forward near the ciliary region. Neoplasms in this region are much fewer than are those situated behind the equator. Although able to place the point of the transilluminator far back on the globe temporally, with the eye in strong adduction, we get little help if the fundus lesions are behind the equator. Such lesions include tumors, tuberculous masses, organized exudates, lesions of Coats's and von Hippel's disease, detached retina with tumor beneath, and collections of blood beneath the retina or choroid. There is one important diagnostic problem in which transillumination is most valuable. This is in the case of pseudoglioma with persistent posterior vascular capsule of the lens with or without hyaloid remnants or added tissue. The diagnostic features upon which we have relied in the past to differentiate glioma endophytum from this type of pseudoglioma are: (1) leaden-gray color of the opaque tissue, (2) position against the posterior surface of the lens, (3) presence of vessels carrying blood, (4) retention of some pupillary action, and (5) fingerlike remnants of the lens capsule laterally running toward the ciliary region. If the transilluminator is applied to the globe well back on either side it will illuminate the whole eye in these cases, and the examiner can see that the tissue on the back of the lens is thin and translucent and that the globe behind the lens is free from opaque material.

Lesions far forward usually induce changes in the ciliary region or iris, simplifying the problem. There is but one way to illuminate the globe from behind while observing the pupil for the shadow of an opaque mass without opening the conjunctiva and the capsule of Tenon. This is done by introducing the Hertzell illuminator far back in the mouth. The source of light is a nitra lamp surrounded by a chamber cooled by running water. The heat of contact is eliminated, but radiant heat cannot be separated from the light, making it necessary to interrupt the current after a half minute. A mask covers the entire face to prevent light returning along the lamp casing at the side through the opening between the lips. The light radiating through the bones of the face is also hidden, but both pupils are visible through openings at appropriate places to permit comparison of the two sides. Langenhan has used this method and reports valuable help in diagnosing tumor, detachment of the retina, and showing the little difference in transparency of opaque optic-nerve fibers. By this method the fundus can be studied with the ophthalmoscope without its own light, in a dark room.

Rather recently two instruments have been designed that will enable us to retroilluminate the eye after an incision is made in the conjunctiva and Tenon's capsule. A type of illuminating device made of plastic has also been introduced, but the glow emanating from the shaft interferes with its effectiveness and an opaque coating of the shaft destroys its conductivity. For this reason, either the Lancaster instrument or the Zeiss is the instrument of choice. The opening of the superficial membranes is a part of every operation for detachment in the absence of general anesthesia. Retroillumination should be a part of every detachment operation. To illustrate the type of case in which this procedure is imperative, the

reader is referred to the cross section of an eye (fig. 1). The lady from whom the eye was removed came because of a sudden attack of pain in a previously blind eye. Six years before, vision was lost suddenly, and a diagnosis of detachment

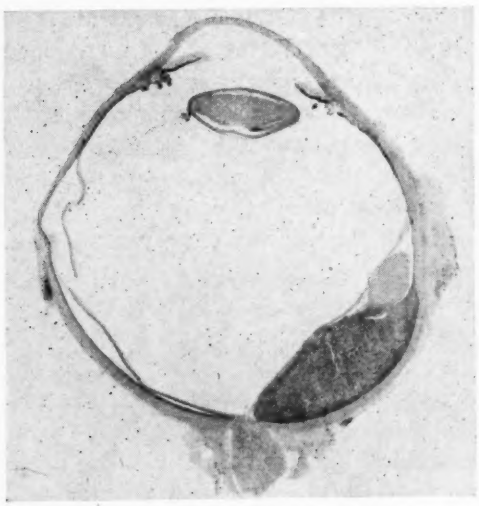

Fig. 1 (Lloyd). Malignant melanoma of the choroid. Eye blind for six years from retinal detachment: then removed because of glaucoma.

was made by the attending oculist. The detachment was plainly seen at the first visit here, but the cornea became steamy, and the eye was removed for glaucoma, with the diagnosis of probable tumor. The eye was transilluminated by Dr. Bernard Samuels and by me, with negative results, which did not change the diagnosis. The illustration shows the tumor diagnosed by Dr. Samuels as a malignant melanoma. Occasionally the operation for detachment is performed when there is concealed tumor well back in the eye, as in this case. The interval of six years between the detachment and the glaucoma brings up interesting questions which are not in place here.

The second eye illustrated (fig. 2) lost vision suddenly, without pain. There were no associated symptoms nor lesions. With the ophthalmoscope a low, dark elevation was seen, about 6 disc diameters in either direction from the fovea, which was at the center, and depressed, as is often the case, for there seems to be greater adhesion between the retina and choroid at that place. At the lower border of the mass a broad strip of blood was observed lying behind the vessels, as if it had seeped down from above. The eye could be transilluminated perfectly. Details of the mass were difficult to make out, and the impression gained was of a dull, dark mass, like choroidal detachment after cataract operation. The retinal vessels were dimly observable on the surface, but very little light was reflected back to the examining eye. The surrounding area was normal. Dr. Ohly saw the case in consultation and

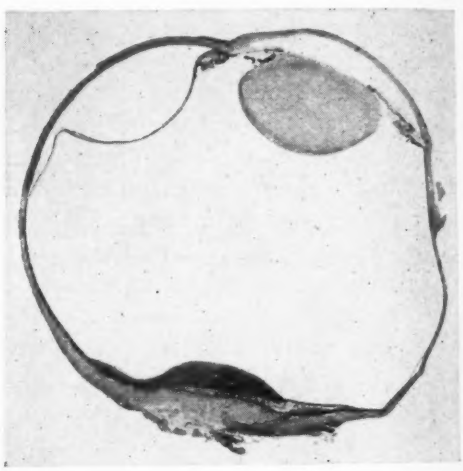

Fig. 2 (Lloyd). Hemangioma of the choroid. Woman, aged 65 years. Normal vision until one month prior to enucleation. Normal intraocular pressure. The opaque mass at the posterior pole is coagulated blood in two layers.

we proposed to the patient than an enucleation should be done if retroillumination showed the mass to be opaque. This was accepted and both the Lancaster and the Zeiss retroilluminators were used by Drs. Ohly and Hargitt after the conjunc-

tiva and Tenon's capsule had been opened. The mass was absolutely opaque to light from the rear, and the eye was removed. The latter was prepared and sectioned by Mr. Burchell, and the diagnosis of hemangioma of the choroid was made by Dr. Samuels. Mr. Burchell reports this as the only hemangioma of the choroid among the 9,000 eyes received in the laboratory during his tenure. The diseased choroid can be seen in the illustration but it is overshadowed by the clot of blood between the choroid and the retina. The blood clot is in two layers as of different ages.

It is hoped that retroillumination will be made a part of the regular routine of enucleation in our eye hospitals. If this is done we shall soon know whether it is possible to differentiate tumors from other masses found in the fundus. Other cases wherein this procedure may clear up diagnostic doubts are those diagnosed as glioma. The typical glioma, like the typical malignant melanoma, is very easy to diagnose, but the ophthalmoscopic picture varies so widely that additional help is welcome. Since beginning this article, retroillumination has been used in a case diagnosed by the pathologist as retinoblastoma. The delicate tissue projected forward from the disc but was opaque when the Lancaster instrument was placed behind the globe at the operation. A very large melanosarcoma, reaching as far forward as the equator, has also been retroilluminated, and was opaque, as was to be expected, because it was easily made out before operation by the usual technique of transillumination. It was demonstrated to best advantage before operation by placing the light at the opposite side of the globe, setting the tumor off well in contrast with the brightly illuminated normal fundus.

The Hertzell technique furnishes enough light so that the fundus can be studied by transmitted light if the room is thoroughly darkened and time allowed the observer to adapt his vision for the lower light intensity. This is not the case in using either the Lancaster or the Zeiss instrument. The Lancaster apparatus is smaller, easier to keep clean, and can be more easily introduced behind the globe.

It is hoped that this article will encourage others to report their cases so that eventually the limitations and advantages of retroillumination may be evaluated. It has long been said that a subchoroidal hemorrhage would cast a shadow, but the second case cited here proves that a relatively thin layer of blood is opaque even if it is anterior to the choroid.

It may be asking too much to expect retroillumination to distinguish between tumors and other masses of tissue in the fundus, except detached retina. We will probably find that the old rule, "an eye without hope of useful vision should be removed," is still the only practical guide in many cases, as it is very doubtful if sarcomas alone are dense enough to cast shadows. We should be able to learn whether a detached retina conceals a tumor.

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THE OCULAR PATHOLOGY OF METHYL-ALCOHOL POISONING*

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PART II

ANIMAL EXPERIMENTATION CARRIED ON BY THE AUTHOR TO DETERMINE THE EFFECT OF METHYL ALCOHOL ON THE OCULAR STRUCTURE OF ANIMALS

In drawing conclusions from research carried out by the author, certain definite statements may be made.

The experiments were done as a check on the work of others. There was some question as to the accuracy of the previous technique used and it was thought by some that the findings were either artifacts due to improper staining or to post-mortem changes.

In this work the author had the satisfaction of eliminating certain technical errors by giving it his personal supervision. The chemicals were given as designated; the eyes were immediately fixed; the microscopic slides were made by experts and were interpreted by an expert eye pathologist who had no information in advance as to what was done to the animal.

In addition to improving the technique, the problem offered an opportunity to settle the question of the importance of impurities in the alcohol. Also, the question of formic acid was considered.

Some hold the opinion that the toxic effect of methyl alcohol is due to the oxidation products. As we know that formic acid is actually formed in the system as the result of oxidation, it was considered advisable to use this in certain cases for comparison of results.

Another phase of the problem which proved to be of value was that a group of animals was carried over a period of two months to determine the effect of prolonged poisoning. Most of the previous work was done on acute poisoning. It was hoped that this might give further information as to the pathologic reaction.

Observation showed that there was an individual variation in the toxic reaction in the various animals and possibly a greater toxic reaction in the dog. No difference could be determined in the reaction of the animals to pure methyl alcohol as compared with commercial methyl alcohol.

The reaction to the methyl alcohol and the formic acid seemed practically the same although in certain instances some of the animals reacted more violently to formic acid.

At no time was there ophthalmoscopic evidence of intraocular disturbance that would suggest edema, although it must be admitted that repeated examinations positively to disprove the presence of this pathologic change were practically impossible and were not made. No apparent visual disturbances were noted.

The following is a brief summary of the positive microscopic findings.

ACUTE POISONING

Rabbit 1. Pure methyl alcohol given. A relatively early stage of acute intoxication was observed, with early chromatolysis of the ganglion cells.

* Candidate's Thesis (condensed) for membership in the American Ophthalmological Sosociety, 1942. Details of the original animal experimentation, which appears in this section of the paper, may be found in the Transactions of that Society, 1942. Part I was published in the July, 1943 issue.

Rabbit 2. Pure methyl alcohol given. The nerve head appeared normal. There was marked vacuolization of the cytoplasm of the large ganglion cells, with practically complete disappearance of the Nissl substance. This is definitely a more advanced chromatolysis than in rabbit 1.

Rabbit 3. Commercial methyl alcohol given. There was practically complete dissolution of the rod-and-cone elements, with a thickening of the subretinal space because of apparent albuminous accumulation. Many of the ganglion cells were reduced to shadow forms, others of the large variety were in a stage of advanced vacuolization. Some edema of the ganglion cell and nerve fiber layers may have been present judging from the increased number of tissue spaces.

Rabbit 4. Same drug as for rabbit 3. The rods and cones were almost completely disorganized and the usual thickening and albuminous appearance of the subretinal space were observed. The ganglion cells showed an advanced stage of chromatolysis. There may have been a small amount of edema in this retina.

Rabbit 5. Formic acid given. Same picture as presented by rabbit 4.

Dog. G. Pure methyl alcohol given. There was early disintegration of the ganglion cells; also, an early acute stage of chromatolysis due to intoxication.

Dog H. Pure methyl alcohol given. An edema of the nerve head was present. There were marked disintegration and infiltration of the rod and cone layer and of the subretinal space. The number of ganglion cells was reduced and those that were present showed marked evidence of degeneration, especially of the cytoplasm.

Dog I. Commercial methyl alcohol given. The nerve and nerve head were apparently normal. These cells were perhaps in an intermediate stage of chromatolysis.

Dog J. Commercial methyl alcohol given. Some edema of the disc of the nerve head was observed. The ganglion cells seemed to be reduced in number.

Dog K. Formic acid given. There was an exudate on the nerve head; perhaps some edema was present in it. The ganglion cells were undergoing acute chromatolysis, with dissolution of the cells. The pathologic picture was one of apparently acute chromatolysis by an overwhelming dose of poison.

Dog L. Formic acid given. There was marked edema of the nerve head—perhaps an early, most profound reaction that may lead to a degeneration of the retina.

CHRONIC POISONING

Rabbit 6. Pure methyl alcohol given. The rods and cones showed a considerable amount of disintegration.

Rabbit 8. Same as for rabbit 6. There was moderately advanced disintegration of the rod and cone elements. Some of the ganglion cells were reduced to shadow forms.

Rabbit 9. Commercial methyl alcohol given. The ganglion cells were only slightly affected. Practically all ganglion cells were involved in the process.

Rabbit 10. Same as for rabbit 9. There was moderate disintegration of the rod-and-cone elements. The ganglion cells appeared to be washed out and poorly stained, and much of the cytoplasm was homogeneous. The appearance was as if the ganglion cells were hit hard by a powerful blow.

Rabbit 12B. Formic acid given. The rods and cones were considerably disintegrated. The usual signs of chromatolysis were present, those indicating disintegration in general.

Rabbit 13B. Formic acid given. Some disintegration of the rod and cone elements was observed. The ganglion cells were not so plentiful as in other speci-

mens and some showed rather marked degeneration.

Dog A. Pure methyl alcohol given. The optic nerve was essentially normal. The rod-and-cone layer of the retina was completely disorganized and there seemed to be an increased albuminous fluid content. This appeared to be a degenerative process of the rod-and-cone nuclei rather than a post-mortem autolytic phenomenon. The ganglion-cell layer appeared to contain an increased number of glial cells and a diminished number of ganglion cells. Of the few ganglion cells that remained, many were in an advanced stage of chromatolysis.

The ganglion-cell layer and the rod-and-cone layer were profoundly degenerated in this eye. Apparently some time had elapsed since the administration of the toxic substance (gliosis).

Dog B. Received the same as dog A. The optic nerve appeared normal. The nerve head appeared as in dog A; the retina and the rod-and-cone elements were not so completely destroyed as in dog A, but there was again a subretinal albuminous fluid and clear tendency toward total dissolution of the rod-and-cone elements; however, these latter elements could still be discerned as shadowy forms. The ganglion-cell layer contained a slight amount of gliosis.

Dog C. Commercial alcohol given. The nerve and nerve head appeared to be normal. There was a slight amount of albuminous fluid beneath the retina, and some autolysis of the rod-and-cone layers. This eye showed early intermediate chromatolysis of the ganglion-cell layer and perhaps beginning autolysis of the rods and cones.

Dog D. Commercial methyl alcohol given. The nerve and nerve head were apparently normal. The rods and cones were in a fair state of preservation. There was unmistakable evidence that some of the ganglion cells had undergone degeneration.

Dog E. Formic acid given. This eye was apparently in the same condition as in dog D. The ganglion cells suggested a greater degree of chromatolysis which might result from the dosage as was given the previous animal but a shorter recovery time.

Dog F. Formic acid given. The nerve and nerve head were normal. The rod-and-cone layer showed changes similar to those observed in the previous two eyes.

Comment. In summarizing the changes in the acute group, it is evident that the microscopic picture did not vary appreciably with the drug used.

The typical finding appeared to be a practically complete dissolution of the rod-and-cone elements, with a thickening of the subretinal space because of an apparent albuminous accumulation. There was some edema of the ganglion-cell and nerve-fiber layers. The ganglion cells were undergoing acute chromatolysis with dissolution of the cells. Large vacuoles were present in the cytoplasm of many of them. Many of the ganglion cells were reduced to shadow forms.

In the case of the optic nerve, some specimens showed a normal appearance whereas others showed an edema of the nerve head recognizable by the increased fluid in the spaces in the nerve head and by the retraction of the retina from the choroidal ring.

The changes found in the chronic group corresponded to those just described except that as a whole, they were more pronounced.

A characteristic description of a chronic case is as follows: The optic nerve was essentially normal. The rod-and-cone layer of the retina was completely disorganized and there seemed to be an increased albuminous fluid content. The

ganglion-cell layer appeared to contain an increased number of glial cells and a diminished number of ganglion cells. Of the few ganglion cells that remained, many were in an advanced stage of chromatolysis. The ganglion-cell layer and the rod-and-cone layer were profoundly degenerated.

This description stresses a more profound change and the presence of glial cells.

In drawing conclusions, it seems evident that the animals reacted similarly to pure methyl alcohol, commercial methyl alcohol, and to formic acid. Although there were variations in degree, the pathologic pictures were similar. Possibly the variations were due to a difference in tolerance of the animals.

It is evident that the retinal changes were not *post mortem* as the eyes were fixed immediately. It is also evident that the predominating changes occurred in the retina, in a few cases manifesting a certain amount of edema of the optic nerve. It seems that the more severe the retinal change, the more evidence of optic-nerve edema.

In comparing the tissue changes found in the group of experimental animals with cases of acute poisoning with those found in the group in which there was chronic poisoning, it is obvious that the latter shows the more extensive and the greater degree of tissue change. In addition, other findings such as gliosis indicate a tissue reaction resulting from a longer exposure.

This would seem to indicate that the prolonged exposure to the toxin does not materially alter the pathologic changes except to accentuate them and, in addition, cause a tissue reaction characteristic of a process of longer duration.

Summarizing this experimental work, the findings in this group of cases would seem to confirm the reports of retinal and optic-nerve changes found in other experimental work of a similar nature.

General Pathology Seen in Cases of Methyl-Alcohol Poisoning

General Symptoms of Poisoning

The symptoms usually exhibited by patients having a toxic reaction from methyl-alcohol poisoning vary in intensity, those who have milder cases showing some moderate evidences of intoxication, and those with severe cases showing extreme prostration. Usually the toxic symptoms come on from 12 to 24 hours after ingestion of the toxin. There is apparently a circulatory disturbance that manifests itself by cyanosis and extreme prostration, a respiratory disturbance that is shown by the reduced number of respirations, and a gastric disturbance evidenced by nausea and vomiting. The patient experiences pain in the head, limbs, and body, but especially in the epigastrium. Sometimes death comes suddenly as a result of paralysis of the respiratory organs. The heart may continue to beat for some time.

Autopsy Findings in Man (Exclusive of the Eye)

In general, two conditions combined to form the usual picture: One was a gastroenteritis of varying severity, the local effect of the poison; the other, a passive congestion of the lungs, brain, and various other organs and a peculiarly colored fluid blood.

The pancreas, spleen, liver, kidneys, lungs and gastrointestinal tract all showed very similar signs; namely edema, hemorrhagic changes and degeneration of the highly specialized tissues such as glomeruli, and the like.

The influence of methyl alcohol on the central nervous system was much like that found elsewhere in the body—capillary congestion, edema, and patchy de-

generation in the neurons. This cellular degeneration is said to occur both in the spinal cord and in the brain. Edema and congestion of the brain and meninges and an increase in the amount of spinal fluid were noted.

Menne[16] reported that the minute alterations observed in the central nervous system (brain and medulla oblongata) consisted of marked subpial and moderate cortical and subcortical interstitial edema, with spotty perivascular and perineuronal extension. Occasional minute focal hemorrhages were noted.

In view of these findings, it is logical to attribute these results in large part to cerebral circulatory disturbances in addition to the direct action of the toxemia.

Blood. There was a decrease in the lymphocytes. The acidity, electro-conductivity, and viscosity were increased, whereas the coagulation time was reduced.

PATHOLOGIC CHANGES IN ANIMAL TISSUES, EXCLUSIVE OF THE EYE

The characteristic changes are as follows:

Brain. The lesions found in the various parts of the cerebrum, the cerebellum, the medulla, and the pons consisted of different degrees of inflammatory and degenerative processes. Macroscopically, the tissues appeared yellowish, glistening; the line of demarcation between the gray and the white matter was not so sharp as in the control animals; in the more prolonged cases the gray matter appeared to be quite thinned and the entire picture one of a nonspecific atrophy.

Microscopically, the ganglion cells were diminished in size and assumed a spindle-like shape. Nissl's granules also were smaller, with brownish pigment scattered here and there. In the most severe cases the parenchymal cells were greatly reduced in numbers as well as in size.

Other nerves besides the optic nerve showed involvement.

Blood. The chemical reaction of the blood serum was found to be acid. Ruggeri[25] found a considerable increase in the fatty acid and cholesterol content of the blood serum.

Heart. The earliest changes in the heart began as an edema and progressed to granular degeneration.

Kidney. The almost constant change in the kidney was a parenchymatous degeneration of the epithelium lining the convoluted tubules.

Liver. The reaction in the liver was practically always one of parenchymatous degeneration.

Gastrointestinal. The stomach's mucous membrane was hyperemic in the form of islets. In some instances the membrane was dropsical, and yellow in places. Quite often there were hemorrhagic spots and erosions. Some ulcers were the size of a quarter. Hyperemia continued to the duodenum and the upper quarter of the small intestine.

Comment. The early symptoms seem to group themselves around a paralysis or depression of both the medulla and the cranial autonomic system, whereas the later symptoms might well be ascribed to the failing functions of the kidney and gastrointestinal tract. It rarely happens that a patient suffering from methyl-alcohol poisoning to this severe degree recovers.

Taken all in all, the picture is that of extreme prostration and is characteristic of an overwhelming toxemia that affects the entire system.

The tissue changes as found in experimental animals are probably of more value in depicting the injurious effect of methyl alcohol than are the human tissues obtained at autopsy. This is because the experimental animal can be more easily controlled and the tissues have not under-

gone post-mortem changes. This applies particularly to the highly specialized tissues such as are found in the central nervous system, kidney, and the like.

However, the susceptibility of the tissues of animals to wood alcohol must be considered in the evaluation, since there is possibly a wide variation in the effects as compared with those in man.

It seems evident that the central nervous system—notably the cerebrum—appears to bear the brunt of the attack, in as much as it, together with the optic nerve, is the most frequently as well as the most extensively involved organ. Next in frequency, but not necessarily in extent of involvement, are the kidneys, the liver, and the muscles.

In drawing conclusions from the foregoing observations it is apparent that most of the changes result from the direct effect of the drug. This toxic element by virtue of its direct effect may cause degenerative changes in the highly specialized tissues such as the central nervous system, kidney, liver, and the like. An edema results that is apparently caused by the corrosive action of the poison. A circulatory disturbance follows and completes the picture.

Conclusions

1. There exists an uncertainty concerning our present knowledge of the action of methyl alcohol on the eye

In reviewing the literature, one is impressed by the diversity of opinion concerning the nature of the ocular pathologic changes. It is surprising that a subject of this scope, which has been the cause of many preventable deaths and blindness, should create so little enthusiasm in the profession that the question as to the exact pathologic process should be left unanswered. The study of the literature has revealed repeated instances in which a human eye and optic nerve could have been fixed in formalin at the moment of death and the specimen could have been thoroughly examined. A statement could then have been made concerning the exact pathologic findings. How much more satisfactory this would have been than to rely upon the results of animal experiments which may not apply to the human organism; to have to depend upon a few vague autopsy reports which, in most instances, were not performed by, or the specimen examined by, ophthalmic pathologists and in which the question of post-mortem changes undoubtedly enter into the picture. As matters now stand, whatever opinions have been expressed either were formed in view of the microscopic findings or were based entirely upon clinical findings and in some instances on both.

In order to draw a conclusion concerning the ocular pathology, it is therefore necessary to depend upon the same data. It does seem to be somewhat of an advantage to view the entire subject in perspective, as is possible when the entire literature is studied. With this background, we can more properly evaluate the evidence at our disposal. It seems, for example, that after familiarizing ourselves with the various symptoms and objective clinical findings, weighing them with the known microscopic pathologic changes and correlating these with our present knowledge of the toxicology of methyl alcohol, we should arrive at a more logical conclusion concerning the true pathology found in the eye.

It must be admitted that after all this is done, the question is not fully settled. It will remain unsettled until, as already suggested, some one will take the time to examine properly a human eye before post-mortem changes have taken place. The problem should not be limited to

this, but rather include other factors that would shed more light upon the toxicologic process and the changes elsewhere in the body.

If some observer would take a few cases before death and carefully carry out a complete blood analysis including a blood chemistry, a complete kidney analysis, a spinal-fluid analysis, and any other procedure that might reveal the nature of the toxicologic process, we would be in a much better position to make more definite statements as to what takes place in the eye.

If, in addition to the pre-mortem analysis, toxicologic and pathologic analyses were made of all tissues at the moment of death before post-mortem changes occur, the problem would be placed on even a more exact basis. Until a complete analysis such as that just described is made, knowledge as to the exact process and associated pathologic changes remains but supposition based upon uncertain factors. But such a study can be made on practically any patient moribund from methyl-alcohol poisoning, without complicating the situation and without much expenditure of time and money.

2. THE OCULAR TISSUES SHOW CHARACTERISTIC PATHOLOGIC CHANGES

In considering this phase of the subject, the eye must be viewed in its entirety. Ordinarily, only the retina and optic nerve are considered in this connection.

It may be stated with a degree of certainty that little or no information has been gleaned regarding any positive pathology in the eye that occurs in this condition except the changes in the retina and optic nerve. There are some data pointing to involvement of the choroid but practically none as to other portions of the eye. Reports of necropsies and animal experiments mention no pathologic changes related to the problem except an increased acidity of the aqueous and a few isolated instances of ciliary engorgement.

Clinical evidence points to conjunctival and scleral hyperemia and to pupillary changes which indicate a break in the reflex arc posterior to the eyeball. No case of iritis, uveitis, cataract, glaucoma, or any other ocular pathologic state has been recorded. A few cases of ptosis and extra-ocular-muscle paralysis have been noted, but these do not apply to the eyeball directly. In the two cases reported by the author, no change attributable to the poison was noted nor was any structure affected except the retina, choroid, and nerve.

Choroid. A study of the microscopic data available seems to indicate the presence of vascular congestion and edema. The vessels are distended, and the choroidal structure shows signs of edema of variable degree. This is usually more pronounced when the adjacent retina is involved, and the degree of change is in proportion to the retinal change. There is, as a rule, very little evidence of an inflammatory reaction; the vascular structure is apparently uninjured.

Retina. One may conclude from the description of the changes in the retina that the toxic effect first makes itself evident in the ganglion cells. After this the inner nuclear layer degenerates, later the outer nuclear layer, and finally the rod-and-cone layer. It is observed that if the layer of ganglion cells is greatly changed, other elements of the retina are also considerably affected.

The general picture of changes in the retina, in addition to the degenerative process, presents the phenomena of dropsical saturation. This is shown in the thickening of individual layers, in separation of cells, in appearance of crevices and spaces, and in dilation and

thickening of Mueller's fibers. The picture observed in the nuclear layers completes this picture of dropsy, for here the cells are not only markedly separated, but appear as if a general current had carried them into the adjacent layers.

Since the degeneration is not always connected with dropsy, it may not be assumed that all these phenomena are conditioned by it, for in places the dropsy is absent, but the degeneration is on hand. It is evident, besides, that in some instances dropsy becomes absorbed and diminishes, for in more chronic cases it is present to a less degree than in acute conditions.

Optic nerve. There is definite evidence that degenerative changes occur in the optic nerve. Accompanying these degenerative changes are found signs of edema to a variable degree.

3. THE VARIOUS OCULAR CHANGES ARE SIMILAR IN NATURE AND ALL THE AFFECTED TISSUES BECOME INVOLVED SIMULTANEOUSLY

That all the pathologic changes found in the ocular tissues are similar in nature is evident upon studying the available data. Although the change may be found to be more pronounced in the retina than in the optic nerve, or *vice versa*, the same type of pathologic change is present in both.

The changes most conspicuous are degeneration and edema. These have been described in the previous section and it is logical to believe that whatever the cause of the process may be, it induces the same tissue changes and reaction in the retina as in the optic nerve. This reaction would naturally be more evident in the microscopic sections of the retina than in the nerve because of the nature of the delicate tissue present in the retina, the latter's less compact arrangement, and other anatomic features that are so different from those found in the optic nerve. In taking these anatomic and physiologic differences into consideration in addition to the possibility of earlier postmortem degeneration, it is only logical to expect more pronounced microscopic changes in the retina than in the optic nerve, especially if the process is early. It is therefore evident that in analyzing the respective findings, we are dealing with a similar process.

That the process involves both the retina and the optic nerve simultaneously seems possible judging from the available data.

In spite of all the clinical evidence to show that the optic nerve is involved first and the process is a descending nerve involvement, there is also evidence, chiefly microscopic, to show that the retina is likewise involved. It cannot be denied that in weighing all the microscopic evidence, both animal and human, we have conclusive proof that the retina shows pathologic changes. This is in spite of the negative results reported by certain reliable investigators. Until it can be proved that these negative results are correct, the author will assume that the retina does show pathologic changes. This contention is based upon the animal experimentation reported in the literature, upon human-tissue findings, the author's experimental results, and the lack of adequately reported experimental data to prove otherwise.

It is possible that the processes in the retina and optic nerve are not dependent upon one another. It has been observed that the degenerative changes appear simultaneously in the optic nerve and in the retina, and are observable within a few hours, a condition which suggests the independence of both processes. Degeneration has been found in the oculomotor and other nerves, which suggests that in such cases an affection of nerves inde-

pendently of the retina is possible. In some cases, the primary affection was noticed in the optic nerve and was of a descending character, and not the reverse, as would have been expected had the retina been first involved; however, at an early stage an ascending atrophy would not be demonstrable. Other factors point to an independent retinal involvement.

Thus, it may be conceded that, as the result of methyl-alcohol poisoning, both retinal and optic-nerve changes may take place simultaneously, reconcile the two extreme views expressed by various authors. It is difficult to admit that either side is in error, but still more difficult to imagine the existence of two situations, one dependent upon the other.

In consideration of all these factors and after weighing all evidence available, it is logical to conclude that the predominating retinal pathologic changes could be explained on the basis of the structure of the retina. Its anatomic and physiologic properties would explain the greater sensitivity to the action of the toxic agent.

It would seem when we consider the nature of the tissues involved that, even though both the retina and optic nerve are exposed to the toxic element simultaneously, the initial injury would be more pronounced in the ganglion cells of the retina, and the microscopic picture would show the predominating changes in the retina.

It is not logical to conclude that the optic-nerve changes seen with the microscope are the result of the injury to the ganglion cells. It is more logical to believe that the changes found in the optic nerve in the acute cases are due to a local injury to the nerve tissue by the toxin and similar to the injury to the ganglion cells.

It is not possible for an ascending degeneration to occur in the optic nerve in the acute cases because the time element would not permit it to manifest itself so soon. It is, of course, evident that later, when the optic-nerve atrophy is present, ascending atrophy accounts for some of the nerve changes. At this stage the optic-nerve atrophy is represented by atrophy both originating in the nerve and as the result of the degeneration of the ganglion cells.

Before concluding this section dealing with the pathologic changes, it should be reëmphasized that the aforedescribed pathologic changes are fundamentally degenerative changes. These degenerative changes not only occur as the result of the action of a toxic substance, but as the result of a metabolic disturbance that interferes with the nutrition of the tissue. It has been demonstrated by Birch-Hirschfeld[26] and others that these degenerative changes occur in the retinal tissue a few hours after the closing-off of nutrition to the retina. By interfering with the circulation for but 15 minutes, Guist[27] demonstrated degenerative changes in the retina.

This being the case, we must consider this factor in interpreting the pathologic changes reported. In the case of the human microscopic reports, evidence points to the fact that, in most instances, the eyes were not fixed immediately. This is based upon the statement of MacDonald,[28] the results in the author's cases, and the lack of a positive statement as to the time of tissue fixation in the other case reports. It must be accepted, therefore, that at least some of the degenerative changes reported can be attributed to post-mortem processes. This does not detract from the fundamental fact that methyl alcohol will also produce such changes, because the author took precautions to prevent post-mortem changes in his animal experimentation by fixing the material immediately.

4. THE EYE CHANGES ARE BUT ONE PART OF THE PATHOLOGIC PICTURE, AND THE WHOLE ORGANISM IS INVOLVED

It seems unnecessary even to make this point, but due to the fact that some may look upon the condition as a specific affection of the eye, it seems advisable to point out the general pathologic changes associated with methyl-alcohol poisoning.

Frequently the lesions of the eye have been so conspicuous as to mask the other toxic manifestations of methyl alcohol. The pathologic conditions arising from these associated effects may be, however, just as constant as, and possibly more important than, the changes taking place in the eye. Also, it is possible that an individual may suffer from methyl-alcohol poisoning in severe degree and still show no ocular changes, just as meningeal lesions are no longer considered essential for the diagnosis of meningococcic infections.

That the eye symptoms are but a local manifestation is evident when the subjective symptoms are considered. In addition to the visual changes, there are signs of profound shock to a greater or less degree. The circulatory, respiratory, digestive, cutaneous, and nervous symptoms all speak for a complete systemic involvement.

The findings at autopsy all indicate much the same type of pathologic change as is found in the eye.

The central nervous system shows in addition to the circulatory disturbance evidence of contact with a toxic substance that produces degenerative changes and edema. The degenerative changes are more pronounced in the highly specialized ganglion cells, which is to be expected because of their sensitivity to disturbance of their chemical structure. Similar changes but to a less degree are noted in the nerve fibers, both central and peripheral.

The specialized cells of the kidney, liver, and other organs, manifest pronounced changes in comparison to less specialized tissues such as muscle.

The gastrointestinal tract shows signs of an irritation that is caused by a direct and repeated contact with the toxin.

The blood findings likewise show changes indicating a toxic reaction. Especially worthy of mention is the presence of acidosis in these cases.

It therefore seems evident that the entire organism is affected although the highly specialized tissues give greater evidence of pathologic change.

5. METHYL ALCOHOL IS BROKEN DOWN IN THE BODY, FORMING TOXIC SUBSTANCES WHICH CAUSE PATHOLOGIC CHANGES

When considering the action of methyl alcohol in the human body, the following factors seem evident:

Individual susceptibility varies markedly, and some people are practically immune whereas others present a definite idiosyncrasy.

Tolerance is not acquired to any degree.

Impurities are not an influencing factor.

Undoubtedly the basic factor in causing the toxic action is the inability of the body to oxidize methyl alcohol to carbon dioxide and water, as is the case in the ingestion of ethyl alcohol. Evidence show that methyl alcohol enters very little into the tissue metabolism. The body does, however, attempt to oxidize it, but does not follow the usual steps. Instead, it deviates, forming other chemical compounds that apparently are more toxic than is methyl alcohol.

The slow elimination of the drug is proof that the body has difficulty in oxidizing methyl alcohol, and the urinary findings, which show methyl alcohol and

formic acid, are further evidence that the body has difficulty in coping with it.

That methyl alcohol is broken down into other chemical products is evident and one or more of them may be the cause of a toxic reaction greater than that caused by methyl alcohol. Formaldehyde may be formed, and there is definite proof that formic acid is formed. Even though formic acid may be formed slowly, it seems possible that it is present for a sufficient time in the body to come in contact with all the tissues, and a momentary contact may be all that is necessary. That it is toxic in the living body has been substantiated by the author's experiments in which formic acid produced at least as great a reaction in the ocular tissues as did methyl alcohol.

The various tests show that methyl alcohol is in contact with the tissues for a considerable time after ingestion, a circumstance that undoubtedly is a possible factor in producing changes of a pathologic nature. The fact that the toxic action (at least the ocular lesions) does not become evident until some hours after ingestion, suggests that some additional factor must be introduced. If the alcohol alone were the cause, the toxic effect would be manifested at once. These observations all point to the fact that the slowly formed decomposition products may play a part in producing at least the ocular changes.

Cumulative effect may be a factor in producing toxic changes, but cases are reported in which only one exposure produced alterations, thus eliminating the possibility of cumulative changes as a major factor.

Acidosis appears to be a factor and may contribute an additional toxic element, and could be partially responsible for some of the tissue changes.

That the toxic action is widespread throughout the entire system is evident. We know that methyl alcohol is distributed to all the tissues and likewise any other toxic element would be similarly distributed. The more highly differentiated tissues, although showing more pathologic change, are apparently not more exposed to the toxic agent than any other tissues.

It therefore seems that the toxic factors which produce the pathologic tissue change could be the decomposition product or products acting with or without the methyl alcohol. Acidosis is also an accompanying factor of more or less importance. Formic acid is apparently one of the important products of oxidization which, acting either alone or in combination with the other toxic elements, is responsible for the deleterious effect on the tissues.

6. THE PATHOLOGIC CHANGE IS THE RESULT OF THE DIRECT ACTION OF THE TOXIC SUBSTANCE ON THE TISSUES

In considering the nature of the toxic action on the tissues theory plays a greater role than fact. The explanation offered must be based upon whatever evidence is at hand. The following statements appear to the author to be logical deductions based upon whatever information is available:

It has been demonstrated that the toxic substances in methyl-alcohol poisoning are highly diffusible and penetrate the eye readily. The toxic substances come in direct contact with all the ocular tissues and produce by this direct action a variable pathologic effect, depending upon the type of tissue. In the case of the highly differentiated elements such as are found in the retina and optic nerve, the effect of the exposure to the toxin is more pronounced. Although this highly sensitized tissue, such as the retina and optic nerve, may not have a special affinity for the toxic substance, there is a possibility that because of the high lipoid content, or for

some other structural or chemical reason, a more pronounced chemical effect is produced than occurs in the less specialized tissue such as the supporting connective tissue, uveal tissue, and the like. It is a known fact that highly developed tissues are always found to be more susceptible to this type of injury than are other types of tissue. It is most probable that the toxic element in some way interferes with the metabolism of the cell and because of its sensitivity to such a disturbance, degeneration takes place in the cell.

This interference with the metabolism of the cell may be of the nature of oxygen famine or some similar chemical process.

Little is known of the mechanism of metabolism of the retina beyond a few isolated facts. The retina certainly has considerable oxidizing powers, and the oxidative capacity is said to increase in light adaptation. In comparison with other tissues it has a marked power of glycolysis. A considerable amount of lipoid substance is also present. Quoting Duke-Elder:

> Its destruction is easy, partly because of the delicacy and complexity of its structure which rapidly falls a victim to noxious influences, and partly because of the intensity of its metabolism which is unable to support the deprivation of essential supplies with impunity for any length of time. It will be remembered that, although the metabolism of the retina is still largely a mystery, we do know that it has a very high oxidative capacity and a glycolytic activity of unusual intensity, about twice that of the iris which is approximately equal to that of muscular tissue. Once an adequate supply of oxygen is cut off, or once the tissue is exposed to the action of leucocytes, exudates, or bacteria, death rapidly sets in.
>
> In the absence of toxic elements, the destruction of the tissue is by autolysis, while in the presence of toxins or inflammatory processes, heterolysis occurs. As a result the retina rapidly becomes swollen and opaque and eventually suffers total atrophy, only a reticulum of the supporting framework of nerve tissue and strands of the connective tissue associated with the blood vessels remaining, while glial proliferation is stimulated.
>
> Autolysis occurs when, in the injured or dying tissues, anabolism cannot maintain its equilibrium with catabolism with the result that acids are formed in excess. The enzymes, which in the normal alkaline retina take part in its metabolism, continue to break up metabolites to form acid products which cannot be dealt with, the increased osmotic activity of which leads to the imbibition of water and a swelling and translucency of the tissues. The proteolytic enzymes then begin to act, hydrolyzing the intracellular proteins into smaller and smaller fragments, and converting the large molecular aggregates into simpler products which diffuse away, eventually leaving only the supporting tissue behind.

It has been shown by Goldschmidt[29] and by Oguchi[30] that as a result of an exposure to the toxic factors of methyl alcohol, the oxidative processes in the retina are much impaired and its respiratory activity lowered, so that the metabolism may be reduced by 40 to 50 percent. Goldschmidt[30] also concluded that the damage is greater when the retina is exposed to light, a view put forward also by Schanz[21] and Schieck,[31] but not universally accepted.

It therefore seems to be fairly well established that the retina and optic nerve are sensitive to metabolic disturbance and that such a disturbance leads to degenerative changes.

It is possible that the toxin acting on the terminal capillaries causes a vasoconstriction and because of the diminished blood supply to the trophic centers, the nutrition of the retinal cells is interfered with and results in a metamorphosis of the cells.

Acidosis has been suggested as a factor contributing to the interference with the tissue metabolism. Titration of the aqueous has demonstrated its presence in the eye. It is possible that it is only a contributing factor.

The injury to the cells may not only be metabolic but may also be due to a direct corrosive chemical action.

Irrespective of the mechanism, the toxic substance produces a degenerative

change in the tissue and especially the highly differentiated tissue such as the cells in the retina and, to a lesser degree, the nerve fibers. That this is not an inflammatory change is evident because of the absence of an inflammatory reaction.

The tissue cells are not all equally affected, for injury seems to occur in patches with intermediate areas of less affected cells. This applies to both the retina and the optic nerve. Such an explanation would account for the scattered scotomata found in perimetric studies. Apparently the papillomacular bundle is especially vulnerable because of the frequent occurrence of central scotomata.

The extent of the degenerative process in the retina and optic nerve is in proportion to the intensity of the toxic element and the susceptibility of the individual.

Edema of the nerve tissue and supporting tissue is the result of both an irritative reaction of the tissue to the toxic substance and the degenerative process.

According to Duke-Elder an essential factor that produces edema is an alteration of the molecular constitution of the retinal tissues whereby large protein complexes are broken down to smaller entities, as is the case in toxemia. In this condition the tissues are starved by the loss of their nutrient blood supply or surfeited with the accumulated waste products of their deranged metabolism, in which case they imbibe fluid freely not only from the retinal capillaries but from the choriocapillaris and probably from the vitreous as well. In its earlier stages the process is reversible, but if the tissue-enzymes, acting freely in the direction of catabolism in the acid media created by the anoxemic state, continue to break down the tissue-proteins, irrevocable damage may be done by autolysis, until eventually a condition of complete atrophy results, wherein the retina is represented only by its more resistant supportive elements.

Edema leads to compression of the nerve tissue and may act as an important factor in causing the initial visual loss by compression of the unaffected and partially affected nerve elements, thus causing temporary interruption of vision. When the edema begins to subside, the nerve fibers gradually resume their function and vision improves in proportion to the number of viable cells remaining. The secondary visual failure is the result of further degeneration of the partially degenerated fibers which did not fully succumb to the original toxic action, but were further injured by the effect of the edema.

As a rule, when the process is confined to the inner layers, the edema may pass off without damage; but once the internuclear layer is seriously involved, permanent damage results.

The edema also may lead to circulatory disturbances by causing a stasis in the vessels supplying the retina and optic nerve.

The inner (cerebral) retinal layers are nourished by the retinal vessels in much the same way as is the case in the central nervous system; the outer layers are avascular, and, being a sensory epithelium, receive their nourishment by diffusion from the choroid.

In the cerebral layers of the retina, the blood vessels do not come into direct contact with the nervous tissue, but are insulated from it by perivascular glial sheaths through which fluid interchange takes place, and by means of which lymphatic drainage is carried out. It is readily apparent that the edema would produce circulatory stasis under these conditions and would be an additional factor in causing a disturbance in the metabolism of the cerebral layer of the retina.

This circulatory interference is also evident in the choroid and supporting structure of the optic nerve and accounts for the hemorrhages that occasionally are found in the optic-nerve sheaths.

This, then, is a statement of the author's interpretation of the process that leads to the pathologic changes in the eye. After weighing the various facts at his disposal such a conclusion seems to be one explanation for the intricate processes that take place. Even if proved incorrect, this interpretation will have served a purpose until more work is done in this poorly understood field.

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ROENTGENOGRAPHY OF EXOPHTHALMOS WITH NOTES ON THE ROENTGEN RAY IN OPHTHALMOLOGY

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PART II*

1. RETENTION CYST OF PARANASAL SINUS (MUCOCELE)

In the writer's experience this is the most common cause of unilateral exophthalmos. In most cases this cyst displaces the eye anteriorly and to one side, usually temporally or inferiorly, producing a solid proptosis. In 13 of the 18 cases in the present series the cyst arose in a frontal sinus, the sinus in most cases having a supraorbital recess which, through pressure, eroded or fractured the roof of the orbit and encroached on the orbital contents. In five of these cases the frontal-sinus disease was unaccompanied by disease of other cells, and in one of the five it was involved in a previous fracture. In most of the cases there was an associated unilateral chronic pansinusitis. In one case of bilateral chronic pansinusitis with typical cyst a diagnosis of epithelioma was made by the pathologist after he had made an examination of the material removed from the frontal cell at operation.

The changes produced in the wall of the orbit and observed in the roentgenogram are quite characteristic. The defect or hiatus of the wall of the clouded sinus, in which frequently a portion of the outline of the cyst can be seen, points to the diagnosis. In many cases a fragment of bone hinged at one side in a trap-doorlike fashion can be seen projecting into the orbit; in other cases a dislocated shell of bone is conspicuous. In two cases of retention cyst of the ethmoid cells the lamina papyracea could be distinguished bulging into the orbit. Malignant tumors arising in the adjacent sinuses can be distinguished by the extensive and irregular destruction of bone which they produce as they invade the orbit. In two cases the cyst arose in the sphenoid cell, and had produced extensive erosion of the nasal side of the optic canal and parts of the adjacent sphenoid and ethmoid cells. One of these cases is reported as follows:

CASE 2. RETENTION CYST OF SPHENOID SINUS. The patient, C. L., a man, aged 43 years, complained of impairment of vision of the left eye which had begun two months before coming for examination. He had occasional aching of the eye, which grew worse on movement. Otherwise he was in good health.

Examination revealed the corrected vision of the left eye to be 20/30, and of the right, 20/15. The fundus of the left eye showed hyperemia of the papilla, with engorgement of the veins. The left visual field was irregularly constricted, and the blind spot was enlarged. The eye showed 3 mm. of exophthalmos and no impairment of motility. The right eye was altogether normal.

The roentgenographic report read in part as follows: "The sella turcica measures 11 by 13 mm., and is involved anteriorly on the left side by a large defect in the bone which includes the sphenoid sinus and the tuberculum sellae. Posteriorly this defect extends from the floor of the sella turcica across the midline, to encroach on the right sphenoid sinus and posterior ethmoid cells (fig. 6). Anteriorly it extends to the middle ethmoids, laterally to encroach on the orbit, and inferiorly it reaches below the ethmoids on the left side. The sella turcica seems to be cut in half. The optic canal is divided vertically and thus the optic nerve must be involved by pressure. The posterior half of the lamina papyracea is missing, and the mass apparently presents in the nasal fossa. The margins of the defect are everywhere sharply defined. . . .

"Impression: The large defect described centers around the left posterior ethmoid cells and upper recess of the left sphenoid, and gives

* Part I of this paper appeared in the preceding issue of the American Journal of Ophthalmology.

the impression, therefore, that the lesion must have arisen in one of these cells and is probably a retention cyst."

Operation. Sphenoidal sinusotomy (left). A large quantity of mucopurulent fluid was evacuated from the sphenoid sinus, and the entire mucous membrane lining of the sphenoid sinus and adjacent ethmoid cells, which were the seat of a huge cyst, were removed.

Microscopic diagnosis. Cyst of sphenoid sinus.

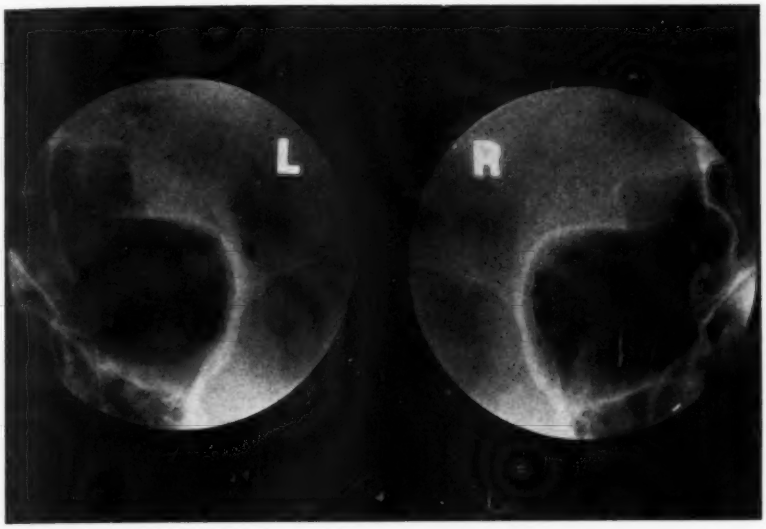

Fig. 6 (Pfeiffer). Case 2. Roentgenogram of the optic canals, showing the large defect of the left side of the body of the sphenoid dividing the optic canal vertically. The right canal is normal.

2. Pseudotumor or granuloma of the orbit (including three cases of Zenker's waxy degeneration)

Pseudotumor of the orbit, singularly enough, yields no roentgenographic findings. This is probably due to the somewhat rapid onset of the exophthalmos, and the earliness in the course of the disease at which the patient presents himself for examination. The course is not sufficiently long or the intraorbital pressure increased enough to produce changes that can be seen roentgenographically. In many cases in the present series increased soft-tissue density was apparent. In one case very definite findings were reported which led to an erroneous conclusion. This unusual case is reported as follows:

Case 3. Pseudotumor of the orbit. The patient, A. M., a man, aged 36 years, complained of severe right frontal and supraorbital headache of two months' duration, and of gradually increasing prominence of the right eye for seven weeks. Neurologic examination was negative.

Examination revealed 4 mm. of solid right exophthalmos, together with a palpable, firm, lobulated mass in the region of the trochlea. Vision, fields, and muscle balance were normal. Wassermann test was negative.

Roentgenographic report. Stereoscopic films of the orbits show the margins to be symmetric and of the mesoseme type. The superior orbital fissures and lines of the temporal fossa are also symmetric. The right orbit shows slight increase in soft-tissue density, and there is no definite evidence of increased intraorbital pressure. The roof of the right orbit shows thickening of the bone, approximately 2 cm. in diameter, several centimeters posterior to the orbital margin, and includes posterior extension of a recess of the frontal sinus (fig. 7). This recess is clouded, and a septum within is thickened. There is no involvement of the bone near the sphenoid ridge. The left orbit is normal. The optic canals are circular in outline, measure 5 mm. in diameter, and are symmetric. The right antrum contains a radiopaque mass which is probably lipiodol. The sella turcica is normal.

Impression: The hyperostosis of the roof of the right orbit is suggestive of a meningioma in an unusual position. The clouded posterior recess of the frontal sinus in the roof of the orbit, which is elsewhere clear, suggests the possibility of infection and osteitis.

Operation. The orbit was explored and a very firm, really hard mass of tissue, measuring a centimeter or so in diameter, was removed, with subsequent improvement in the exophthalmos but no improvement in the headache of which the patient complained.

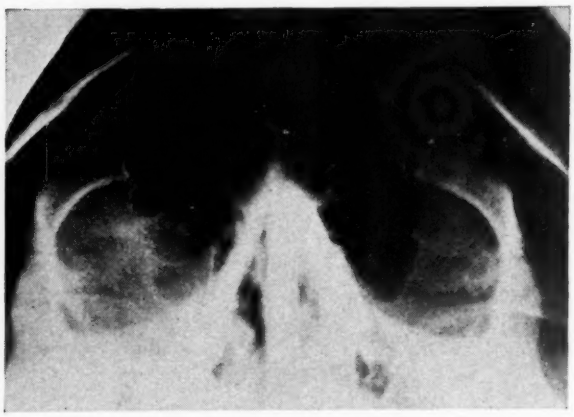

Fig. 7 (Pfeiffer). Case 3. Pseudotumor of orbit. Roentgenogram showing thickening of bone in the roof of the right orbit involving a recess of the frontal sinus, which is clouded, and which shows thickened septae.

Pathologic diagnosis. Granuloma or pseudotumor. Because of continued headache, a right frontal craniotomy was subsequently performed in another hospital. A mass of tissue similar to that removed from the orbit was found attached to the bone of the roof of the orbit and was excised. This tissue was found to resemble that removed from the orbit.

3. Meningioma

Meningioma is the name proposed by Cushing[18, 19] and now in use, for a most interesting and benign tumor that arises in the cell clusters of the arachnoid. It may originate wherever arachnoidal tissue is found, and has favorite sites of origin, with corresponding symptomatology. Several of these favored locations are around the orbit, where the tumor may involve the optic nerve or even the globe itself. Arising in the arachnoid surrounding the optic nerve; it may be primary in the orbit. In most cases the orbit is involved by direct growth of the tumor through bone, to give rise to a neoplasm of the orbit itself.

The meningioma displays a tendency to produce hyperostosis, which is an additional cause of exophthalmos. The overgrowth of bone is particularly common in those cases in which the tumor arises on the sphenoid ridge. In this position it is frequently the *en plaque* variety of growth, and may produce hyperostoses of relatively large size. The hyperostosis may be found at any point on the sphenoid ridge, and at the beginning may appear as a slight thickening of the bone, with smooth cortical surfaces and without visible spicule formation. When it is found on the inner half of the crest, the thickening may at first be limited to the lesser wing of the sphenoid, apparently by the suture line. When small, the hyperostosis is usually of a porous nature. Later the shadow of the bony overgrowth on the film may be of uniform increased density, because of the failure of the ray to penetrate the mass. The latter may be so large as to occupy the entire middle fossa and perhaps most of the orbit. At this stage of development such hyperostoses have been referred to erroneously as osteomas. Their size is no indication of the size of the parent soft-tissue tumor. In the present series of cases this affection of bone was much more extensive when produced by neoplasms arising in the outer half of the sphenoid crest.

According to Cushing and later authors,[46] the hyperostosis results from the growth of the meningioma into and through the Haversian canal system of the bone. In consequence of this the bone seemingly becomes irritated with subse-

quent osteoplastic proliferation, which gives rise to the hyperostosis. The more common intracranial position of the tumor, with pressure on the brain, is believed to play no part in the process. This theory is supported by the development of hyperostoses by meningiomas in extracranial locations. Because of the tendency to bone formation that is found occasionally within the tumor, Cushing suggested that the cells of the growth might bear some relation to the bone-forming properties of the meninges.

In contrast to this striking picture, the meningioma may be unassociated with thickening of the bone. This was the case in two of the patients with exophthalmos in the present series. All things considered, only a small percentage of all intracranial meningiomas produce hyperostosis.

Positive roentgenographic diagnosis of the lesion is made in cases of exophthalmos when the typical hyperostosis is demstrated in a characteristic location on the sphenoid crest or around the optic canal. If the hyperostosis is absent, a presurgical diagnosis may not be made with certainty in some cases, even with the aid of pneumoencephalography. It should be pointed out again that overgrowth of bone may be produced by tumors other than meningiomas.

Meningiomas present four different syndromes, with which the ophthalmologist should be familiar; namely, meningiomas of—(1) the optic nerve, (2) the sphenoid ridge; (3) the tuberculum sellae; and (4) the olfactory groove.

Meningiomas of the optic nerve usually cause loss of vision, with optic atrophy or papilledema and exophthalmos. They may occur during the second, third, fourth, or fifth decades of life—just as may any meningioma. They grow slowly and painlessly. The diagnosis may be based on the roentgenographic findings. One patient reported by Johnson[26] had exophthalmos due to a very large intraorbital tumor. The growth undoubtedly arose primarily within the orbit, for the enlargement of the optic canal was barely perceptible. The case described below has not previously been reported, and is a classic example:

CASE 4. MENINGIOMA OF THE OPTIC NERVE.. The patient, M.F., a girl, aged 12 years, was brought for examination because of blindness in the right eye which had been observed two years earlier. Some weeks before examination the parents had noticed that the right eye was prominent. The patient had no pain and was in good general health (fig. 8).

Fig. 8 (Pfeiffer). Case 4. (Meningioma of the optic nerve). The patient, a girl, aged 12 years.

Examination. The right eye was found to be without light perception and to show 5 mm. of solid exophthalmos. The fundus showed 3 diopters of papilledema. There was limitation of the motility of the eye in all of the cardinal points of gaze. The left eye was normal.

Roentgenographic report on the orbits was as follows: "The orbits are asymmetric in size and contour. The right orbit is greater in capacity, and the intermarginal opening measures 39 mm. horizontal, 50 mm. vertical, and the left measures 38 mm. by 46 mm. The portion of the orbit near the apex is enlarged, showing concavity or increased concavity of all the walls adjacent to the optic canal. The right sphenoid ridge nasally is slightly heavier and denser and the superior orbital fissure is slightly larger than the left. The floor of the right orbit is very slightly depressed, and all of the walls are thin as a result of the increased intraorbital pressure.' The right optic canal is quite irregular in contour, measures approximately 3.5 by 6.5 mm., and is surrounded by bone of increased density (fig. 9). The left orbit is normal, and the left optic canal measures 5.5 by 6.5 mm. All the paranasal sinuses are clear, except the right antrum in which there is some thickening of the lining membrane.

"Impression: The larger right orbit indicates increased intraorbital pressure of fairly long standing. The demonstrable enlargement of the orbit near the apex suggests the location of a tumor in this position. A curious formation of the optic canal, together with the increased bone density, suggests a tumor of the optic

nerve or the sheath; this is probably a meningeal fibroblastoma."

At *operation* a firm encapsulated tumor was found attached to the apex of the orbit, surrounding the optic nerve. The growth was loosened by finger dissection and excised along with the portion of the optic nerve (fig. 10).

Pathologic diagnosis. Meningioma of the orbit.

Meningiomas of the sphenoid ridge may be divided into three groups according to their position on the ridge: (1) Those arising on the middle third may produce large hyperostoses and exophthalmos, without subjective symptoms; (2) those arising on the outer third frequently involve the temporal fossa and produce bulging of the temporal area, which can be noted clinically. This was present in five of the writer's cases and, when observed clinically, is most indicative. The following case is typical:

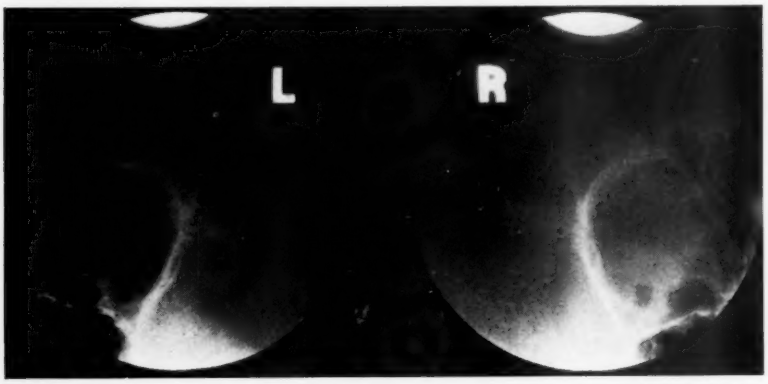

Fig. 9 (Pfeiffer). Case 4. Roentgenogram of the optic canals, showing the surrounding hyperostosis and the irregular configuration of the right. The left canal is normal.

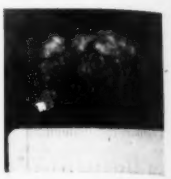

Fig. 10 (Pfeiffer). Case 4. The tumor, after removal, surrounding and compressing the optic nerve.

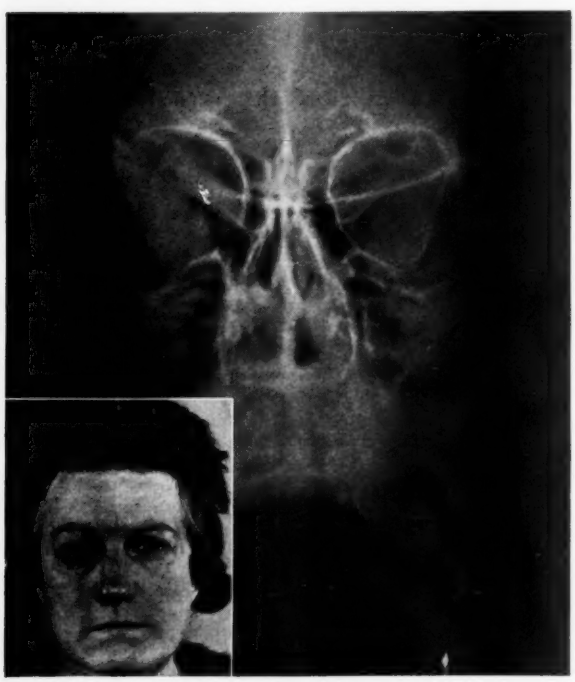

Fig. 11 (Pfeiffer). Case 5. Meningioma of outer portion of sphenoid crest (inset). Roentgenogram showing extensive hyperostosis of the sphenoid ridge and outer wall of the orbit involving the temporal fossa. Note the prominence of the right temple of the patient as compared with the left.

CASE 5. MENINGIOMA OF OUTER THIRD OF THE SPHENOID CREST. The patient, L. M. M., a woman, aged 46 years, complained of gradually increasing protrusion of the right eye over a period of one year. She had no disturbance of vision, but suffered an occasional dizzy spell, which may not have been related to the cause of the present illness.

Examination. The right eye was displaced anteriorly 4 mm. and could be replaced or pressed back into the orbit 2 or 3 mm. The visual fields and fundi were normal, and there was no disturbance of the sense of smell. A bulge

on the right side of the head over the temporal fossa could be made out.

Roentgenographic report was in part as follows: "The right sphenoid ridge is greatly thickened from the anterior clinoid, where it is scarcely visible, to the side of the vault, where a very large hyperostosis with increased vascularity of the area is present. The right optic canal is not involved.

"Impression: Meningioma of the right sphenoid ridge involving principally the outer two thirds and side of the vault (fig. 11)."

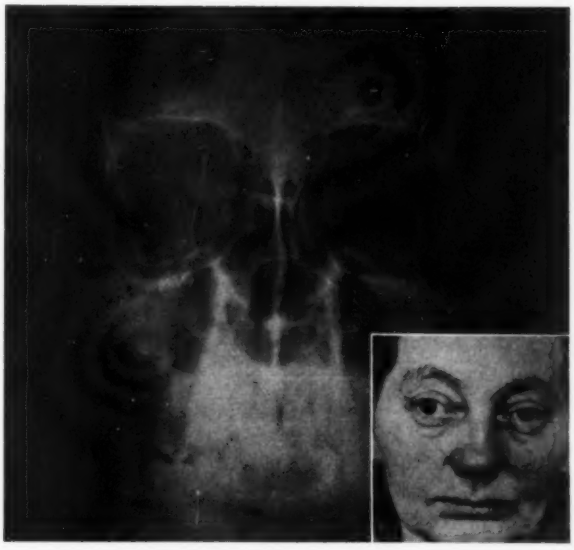

Fig. 12 (Pfeiffer). Case 6. Meningioma of inner third of sphenoid ridge (inset). Roentgenogram showing the hyperostosis involving the lesser wing of the sphenoid of the right orbit, together with thickening of the lateral wall of the orbit adjacent to the superior orbital fissure.

(3) Meningiomas arising in the inner third of the sphenoid crest promptly involve the optic canal, and impinge on the optic nerve, producing atrophy of the nerve or papilledema, and subsequent exophthalmos. The following case is illustrative:

CASE 6. MENINGIOMA OF INNER THIRD OF THE SPHENOID CREST. The patient, M. M. R., a woman, aged 48 years, complained of loss of vision which began six years ago. She had been totally blind for four years. The right eye had subsequently turned out and become prominent. The left eye was perfectly normal.

Examination. The right eye was found to have no light perception; it showed 2 mm. of exophthalmos, and was displaced slightly laterally. The fundi showed a complete secondary optic atrophy.

Roentgenographic report read in part as follows: "The right orbit is slightly larger and the medial half of the sphenoid ridge, including the anterior clinoid, is decidedly thicker. The margins of this thicker portion are smooth and the bone is porous in nature. The right optic canal is irregular in contour and is entirely surrounded by the hyperostosis (figs. 12, 13).

"Impression: Meningioma of the medial half of the sphenoid ridge, involving the optic canal."

Pathologic diagnosis. Meningioma.

In two cases of meningioma of the sphenoid ridge hyperostosis was not present, and a positive roentgenographic diagnosis could not be made. This is sufficiently unusual to justify a description of the findings. In both cases the orbits showed an extreme degree of increased intraorbital pressure with atrophy of the walls of the orbit. The exophthalmos in

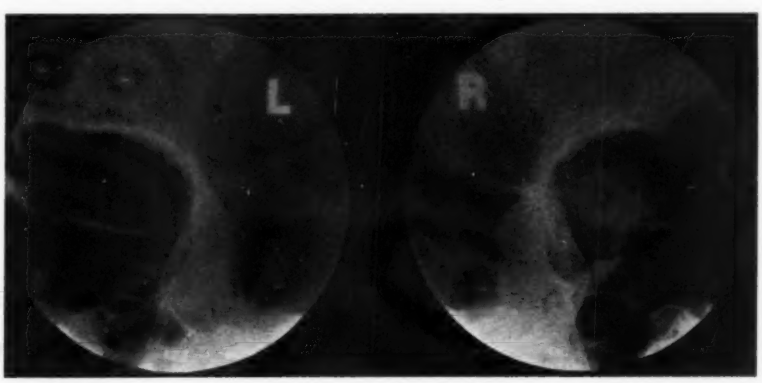

Fig. 13 (Pfeiffer). Case 6. Roentgenogram of the optic canals, showing the hyperostosis surrounding the right canal, which is somewhat contracted.

both cases was inordinately severe.

CASE 7. MENINGIOMA OF ORBIT WITHOUT INVOLVEMENT OF OPTIC NERVE OR SPHENOID RIDGE. The patient, R. C., a woman, aged 40 years, first noticed a beginning prominence of the left eye four or five years before coming for examination. The prominence increased gradually and painlessly, without loss or disturbance of vision and without general symptoms.

Examination. The corrected vision of each eye was 20/20; the visual fields were normal; and the blind spot of the left eye was slightly enlarged. The fundus of the left eye showed slight edema of the papilla. The left eye measured 12 mm. of exophthalmos with limitation in all directions of gaze. The eyeball could not be replaced, and no tumor masses could be felt.

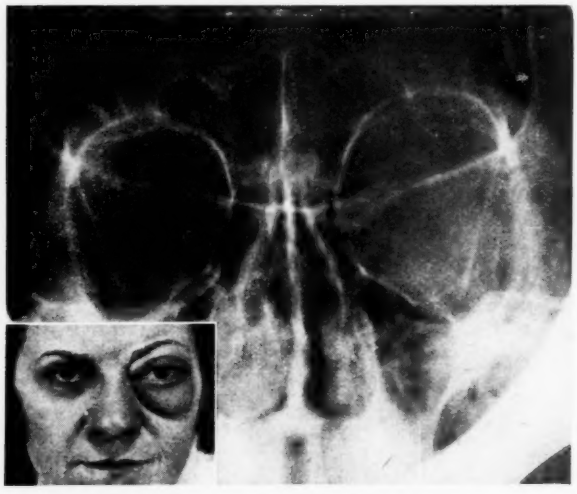

Fig. 14 (Pfeiffer). Case 7. Meningioma of orbit without apparent involvement of the optic nerve or sphenoid ridge (inset). Roentgenogram showing striking enlargement of the left orbit as a result of increased intraorbital pressure. Note the increased capacity of the cavity, the enlargement of the entrance, the increased concavity of the walls, and the increased soft-tissue density.

Roentgenographic report. Stereoscopic films of the skull and orbits show the calvaria to be of average thickness, with normal convolutional impressions, vascular channels, and sutures, and to be mesocephalic in type. The temporal bones are moderately well pneumatized and clear. The petrous ridges are equal, and the basal angle is normal. The sella turcica measures 10 by 13 mm. and is not deformed. The tuberculum sellae is normal. There is no calcium to be seen in the normal position of the pineal body.

The left orbit is larger than the right, and the intermarginal opening measures 50 mm. vertical by 44 mm. horizontal, while the right measures 44 by 40 mm. The capacity of the left orbit is markedly increased, and the walls are slightly atrophic and more concave. Increased soft-tissue density is apparent. There are no dehiscences of the walls. The sphenoid ridges and superior orbital fissures are almost normal. The right orbit is altogether normal in appearance. The optic canals are nearly circular in contour, measure approximately 5 mm. in diameter, and are symmetric. All of the paranasal sinuses are clear (fig. 14).

Impression: The left orbit shows an extreme degree of increased intraorbital pressure which is undoubtedly due to a tumor within and which may well be a hemangioma.

Histologic diagnosis. Meningioma.

CASE 8. MENINGIOMA OF SPHENOID CREST WITHOUT HYPEROSTOSIS. The patient E. G., a woman, aged 47 years, desired new glasses for reading, and on examination was found to have prominence of the right eye, which she had noticed for two months.

Examination. The right eye showed anterior displacement of 9 mm., which could not be reduced by pressure. The visual fields and blind spots were normal, and the fundus of the right eye exhibited slight edema of the papilla.

Roentgenographic report read in part as follows: "The orbital margins are symmetric and of the mesoseme type. The sphenoid ridges are equal in position and contour, but the right is not distinctly revealed. The right superior orbital fissure is also somewhat indefinite. The roof of the right orbit is coarsely mottled in such a fashion as to suggest cribri orbitalis. The capacity of the right orbit is greater than that of the left, and shows increased soft-tissue density. The optic canals are roughly circular in contour, measure 6 mm. in diameter, and are nearly symmetric (fig. 15). All the paranasal sinuses are clear.

"Impression: The evidence of increased right intraorbital pressure indicates the presence of a primary neoplasm within. The meaning of the indefinite right sphenoid ridge and fissure is not clear, but may have to do with increased pressure if it has existed over an especially long period of time."

Exploration of the orbit was performed and a hard, round fingerlike mass attached to the bone near the apex of the orbit was found and removed by blunt dissection.

Histologic report. Meningioma of the orbit.

Meningioma of the tuberculum sellae[43] is not discussed in this paper because it does not produce exophthalmos. It was diagnosed in three cases in the writer's laboratory on the basis of bone changes in or near the tuberculum, but pneumoencephalography is usually required.

Meningioma of the olfactory groove,[44] which produces the Gower-Kennedy syndrome, is also beyond the scope of this paper, since it does not produce exophthalmos.

4. CRANIOSTENOSIS (TOWER SKULL, OXYCEPHALY, TURMSCHÄDEL, PREMATURE-SUTURE SYNOSTOSIS)[20, 21]

This bizarre congenital condition, which is chiefly an ophthalmologic problem because vision is so frequently impaired and because of the exophthalmos, is usually quite easily recognized in the roentgenogram. There are various degrees of it, however, and some are very slight and can be readily overlooked. The shape which the skull assumes depends on which sutures were prematurely closed, and the severity is dependent upon the extent and number of sutures that are closed. The roentgenographic characteristics of the condition are the unusual shape of the calvaria, the prominent convolutional impressions, the premature fusion of one or more sutures, the depression of the basal angle, the anterior displacement of the sella turcica, and the shallow orbits. The last of these—the shallow orbits—are responsible for the exophthalmos. The changes are due to the failure of the bones of the vault to maintain their growth with the growing brain, and the consequent increased intracranial tension, which tends to follow Pascal's law. The following is a typical case:

CASE 9. CRANIOSTENOSIS. The patient, C. J. P., a girl aged five years, was brought for examination because of prominent eyes, which had been observed since birth, and on account of the unusual shape of her head. She was a premature infant of seven months, and many different diagnoses had recently been given. She was of normal intelligence and her general health was good.

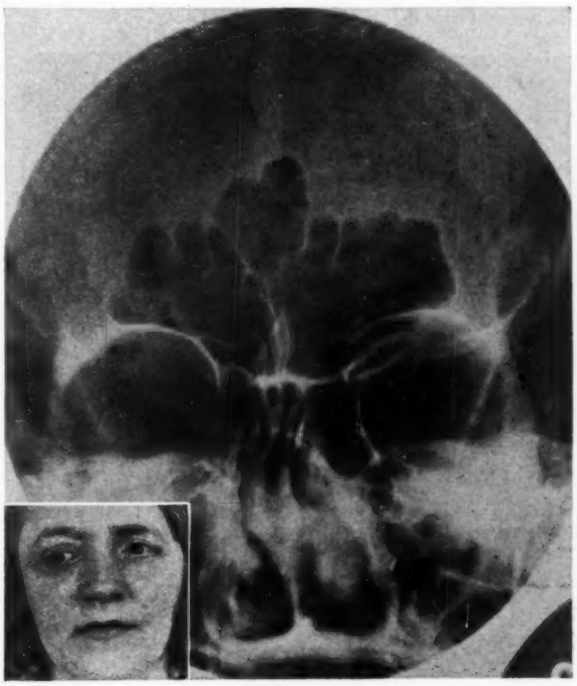

Fig. 15 (Pfeiffer). Case 8. Meningioma of sphenoid crest without apparent hyperostosis. Roentgenogram showing the effect of increased pressure in the right orbit. Note the increased concavity and thinness of the walls, the increased capacity of the cavity, and the enlargement of the orbital entrance.

Examination. Both eyes were very prominent, and the left turned in (esotropia of 20 centrads). Vision of each eye was 20/70, which improved to 20/30 with correction of a moderate degree of compound hyperopic astigmatism. The fundi were normal.

Roentgenographic report was as follows: "Examination of films of the skull shows the calvaria to be well outlined, with the tables thinner than the average, and to be oxycephalic in shape. The convolutional impressions are

inordinately marked. The vascular channels are not apparent, and the coronal sutures are solidly fused. The saggital and lamboidal sutures appear normal. There is a characteristic basal depression, with the angle approximately 180°. The sella turcica is anterior to its normal position and is not deformed. The middle fossa extends far forward, compressing the orbits, which are extremely shallow.

"The margins of the orbits are fairly symmetric and of the mesoseme type. The roofs of the orbits are flat and short, and the sphenoid ridges, superior orbital fissures, and temporal lines are unusual though symmetric. The optic canals are symmetric, oval in contour, and adequate in size.

"Impression: Oxycephalic skull of the classic type. The bilateral exophthalmos is due to the shallowness of the orbits."

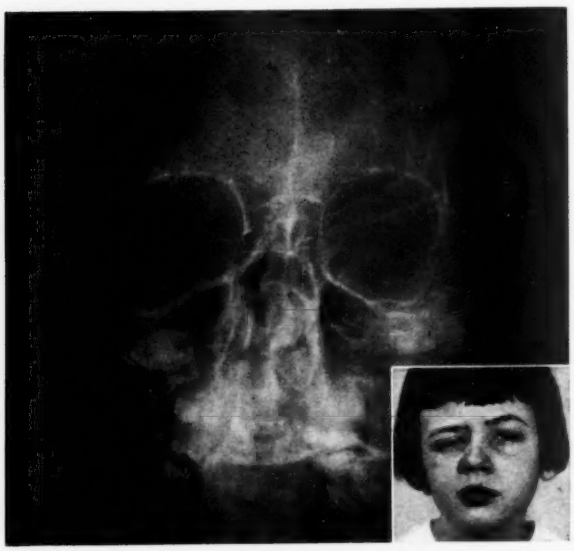

Fig. 16 (Pfeiffer). Case 10. Plagiocephaly and unilateral exophthalmos (inset). Roentgenogram showing mild degree of craniostenosis with asymmetric calvaria and orbits explaining the asymmetric position of the eyes.

That craniostenosis may be unilateral in maximum severity (plagiocephaly), and thus capable of producing unilateral exopthalmos, may not generally be appreciated. The following case is representative:

CASE 10. PLAGIOCEPHALY AND UNILATERAL EXOPHTHALMOS. The patient, M. D., a girl, aged 10 years, was brought for examination because of drooping of the left upper lid and defective vision of the right eye.

Examination. The corrected vision of the right eye was 20/70, and of the left, 20/30. The face was asymmetric, with the right eye more prominent and at a slightly lower level. The fundi were normal. The visual fields appeared to be complete. The right eye showed 4 diopters of hyperopic astigmatism, and the defective vision of this eye was attributed to amblyopia ex anopsia. There was partial ptosis of the left eyelid of 3 mm.

Roentgenographic report. Films of the skull show the calvaria to be well outlined, with tables of average thickness, and to be quite unusual in shape. There is complete fusion of the left coronal suture, and the remaining sutures are normal in appearance. The convolutional impressions are accentuated, and the vascular channels are not demonstrable. The right half of the skull is greater in size than the left, which shows definite inhibited development. The left parietal region is somewhat flattened, and is lower than the right, which characterizes the skull as plagiocephalic. The left sphenoid ridge is higher than the right. The sinuses of the right side are larger than those of the left. The basal angle is greater than usual. The sella turcica measures approximately 8 by 10 mm. and is not deformed. The right orbit appears to be smaller in capacity than the left. The optic canals are asymmetric in position and are fairly symmetric in size, measuring approximately 5 by 6 mm. (fig. 16).

Impression: Mild degree of partial craniostenosis. The premature closure of the left coronal suture is responsible for the asymmetric development of the skull and orbits. The right side grew to compensate for the left, which lagged in development.

5. HYPERTHYROIDISM

Most of the cases diagnosed as hyperthyroidism were sent to the X-ray Department for study because of some unusual features of unknown significance. Definite cases were sent directly to the Medical Department. Five of the cases that were roentgenographed showed unilateral exophthalmos, and most of the other cases showed exophthalmos with-

out the clear-cut clinical picture of the disease. Roentgenographic findings were absent in all save one, and this was irrelevant to the diagnosis. A number of the cases showed demonstrable increased intraorbital soft-tissue density. In these and in many other cases of hyperthyroidism which were examined before the series was begun, definite evidence of increased intraorbital pressure was never found.

6. Cavernous hemangioma

This tumor, generally regarded as the most common primary neoplasm of the orbit, is probably always congenital in origin, and may grow so slowly that its presence may not become suspected until as late as the fifth decade of life. When located deep in the orbit, these growths most commonly produce roentgenographic evidence of increased intraorbital pressure. When this roentgen finding occurs in association with free motility of the eye in spite of the extreme exophthalmos, the evidence is strongly suggestive of hemangioma. One of the cases in the present series had an orbital varix which produced intermittent exophthalmos. When the child strained or leaned forward the proptosis became pronounced, but disappeared when she relaxed in a supine position.

The following brief case report is typical of most hemangiomas:

Case 11. Hemangioma of the orbit. The patient, L. L., a girl, aged 17 years, developed a slight prominence of the left eye at the age of two years. She was treated by operation, with apparent cure. Two years before the present examination the eye had begun to protrude a second time, without concomitant symptoms.

Examination. Vision of each eye was 20/10, with normal fields and blind spots. The left eye was displaced forward 10 mm., and a little downward, and could not be replaced.

Roentgenographic report read as follows: "The left orbit is very much enlarged because of apparent increased intraorbital pressure. The intermarginal opening is greater in all diameters. The walls are somewhat thin, and all tend to be concave. The adjacent paranasal sinuses of the left side are smaller. There is marked increased soft-tissue density with greater density above, suggesting a tumor (fig. 17).

"Impression: Deformity of the left orbit is due to a primary intraorbital tumor, probably a hemangioma."

Operation. Through a canthotomy incision a large encapsulated hemangioma was bluntly dissected free and removed with the index finger.

Pathologic report. Hemangioma.

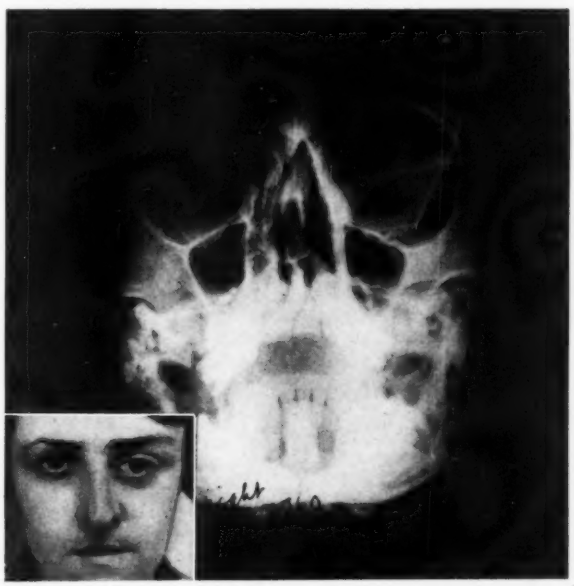

Fig. 17 (Pfeiffer). Case 11. Hemangioma of orbit (inset). Roentgenogram showing striking enlargement of the left orbit due to increased intraorbital pressure.

The foregoing case is the only one in which we came near to visualizing the tumor itself in the orbit. One must not expect to find in the orbit circumscribed soft-tissue shadows produced by new growths for the reason that tumors usually have the same density as the remainder of the tissue of the cavity. The injection of air into the orbit as an aid to diagnosis of tumor, as suggested by

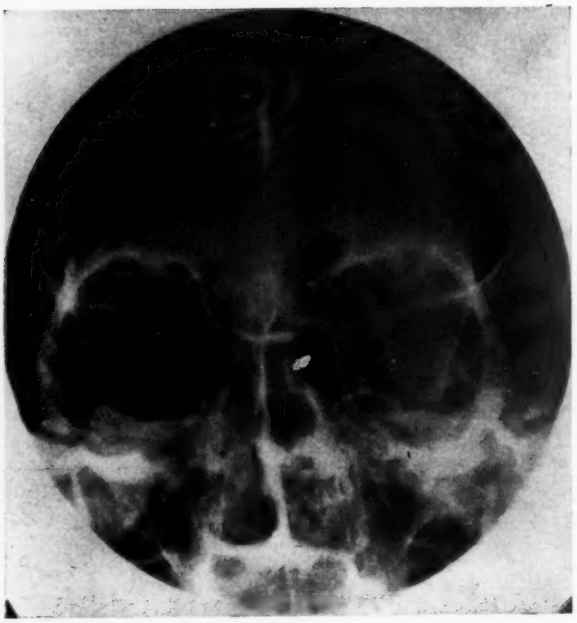

Fig. 18 (Pfeiffer). Case 12. Hemangioma of orbit. Roentgenogram showing slight enlargement of the left orbit, with increased soft-tissue density.

Last,[22] has not been found useful in the author's hands.

The following case is interesting since the exophthalmos developed late in life and increased intraorbital pressure was demonstrable:

CASE 12. HEMANGIOMA OF ORBIT. The patient, S. D., a woman, aged 45 years, had had increasing left exophthalmos for four years, without pain or loss of vision.

Examination. The corrected vision of each eye was 20/15, and the visual fields and blind spots were normal. The left eye was displaced forward and slightly downward 6 mm., had free motility, and was not replaceable. The fundus of the left eye showed slight bulging of an area around the fovea, and on refraction the eye showed 2 diopters of hyperopia. The right eye was almost emmetropic.

Roentgenographic study was reported in part as follows: "The capacity of the left orbit is greater than the right because of increased intraorbital pressure. Increased soft-tissue density is apparent. There are no dehiscences in the walls of the orbit, and the adjacent paranasal sinuses are normal in size and are clear (fig. 18).

"Impression: Tumor of the left orbit, probably hemangioma, although age is not in favor of this."

Operation. Through a lateral canthotomy incision a large encapsulated hemangioma was found between the outer wall of the orbit and the lateral rectus; this was removed by blunt dissection with the finger.

Histologic diagnosis. Hemangioma.

Final result. The eye returned to a normal position without any limitation of motility or resulting double vision. In several weeks' time the patient was fully recovered (fig. 19).

The following case is so unusual as to warrant its description in detail here. This is another instance of pulsating exophthalmos due to congenital defect of the orbit, but differs in that the developmental defect in the bones was due to an extensive retrobulbar hemangioma.

CASE 13. HEMANGIOMA, PULSATING EXOPHTHALMOS, DEFECT OF THE ORBIT. The patient, B. F., a girl, aged eight years, was brought for examination because of the prominence of the right eye, which was first noticed at the age of four, when she had had infantile paralysis. Recovery from the paralysis was complete, and the child has not had any subjective symptoms.

Examination. There was 3 mm. of right exophthalmos, and pulsation of the eyeball synchronous with the radial pulse. The eye was displaced directly forward and appeared to be slightly convergent. Several dilated veins were present on the sclera. There was no interference with motility, and diplopia was absent.

Fig. 19 (Pfeiffer). Case 12. The patient before and after operation.

Corrected vision of each eye was 20/30. Binocular single vision in all fields of gaze, and normal fields. No bruit could be heard. Another singular feature of the case was the presence of a Marcus Gunn phenomenon.

Roentgenographic report of the orbits was in part as follows: "The right orbit shows a very large defect or hiatus in the roof and lateral wall in which there is no evidence of the sphenoid ridge or superior orbital fissure. The margin of the defect above is irregular or serrated, and in places seems to be perforated. The line of the temporal fossa is irregular and concave inward. All the right paranasal sinuses are smaller than the left. The optic canals are symmetric, measure 5 mm. in diameter, and are not deformed. The defect of the right orbit has spared the canal. The left orbit is entirely normal (fig. 20).

"Impression: The striking defect in the right orbit through which the middle fossa communicates with the orbit is probably congenital and accounts for the pulsation of the prominent right eye. The remarkable character of the margins of the defect is quite suggestive of a hemangioma of the bone which was probably responsible in the first place—that is, in the embryo—for the defect of the several bones of the orbit."

Subsequent history. In later years an irregular bluish mass could be seen posterior to the globe when the eye was turned nasalward as far as possible. On two occasions when the child sustained bumps of the head, extensive hemorrhages occurred in the orbit.

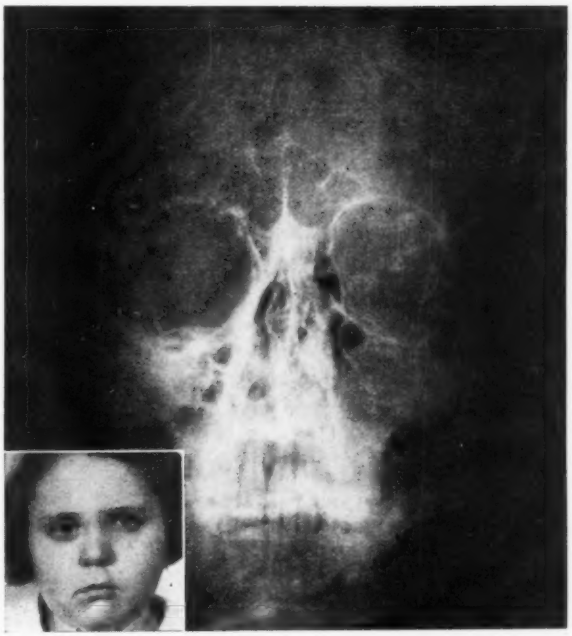

Fig. 20 (Pfeiffer). Case 13. Hemangioma of orbit associated with defect of the roof and lateral wall, with pulsating exophthalmos (inset). Roentgenogram showing a very large defect or hiatus in the roof and lateral wall of the right orbit, with absence of sphenoid ridge and superior orbital fissure. Note the perforated and serrated margin of the defect above, the deformity of the temporal line, and the adjacent paranasal sinuses.

The single case of *venous angioma or orbit varix*, because of its rarity and because of the roentgen findings, merits description.

CASE 14. VENOUS ANGIOMA OF THE ORBIT. The patient, J. L., a boy, aged five years, was brought for examination because of recurring right exophthalmos which had been observed from time to time since birth. When the patient would lean forward, or when straining, the eye would come forward and become very prominent. At other times, and especially when lying on his back, the eye would sink deeply into the socket, "out of sight."

Examination. The right eye was found to act in the way the mother described. The exophthalmometer readings were as follows:

Sitting upright:	O.D. = 14 mm.
	O.S. = 13 mm.
Lying prone:	O.D. = 22 mm.
	O.S. = 15 mm.
Lying supine:	O.D. = 10 mm.
	O.S. = 12 mm.

There was no pulsation of the eyeball at any time and there was no limitation of motility. The visual acuity was normal for each eye. The fundi were also normal.

Roentgenographic description of the orbits was as follows: The margins of the orbits are asymmetric, the right measuring 44 mm. horizontal and 46 mm. vertical, and the left 42 by 44 mm. The cavity of the right orbit is larger, and there are no dehiscences of the walls. The posterior convexity of the floor of the right orbit is not comparable to that of the left and normal orbit. The sphenoid ridges and superior orbital fissures are slightly asymmetric. The optic canals are fairly symmetric in size and contour, and measure approximately 5 by 6 mm. All of the paranasal sinuses are infantile and clear.

Impression: The right orbit is slightly larger than the left and is not otherwise abnormal. This is consistent with a retrobulbar venous angioma which is probably responsible for the behavior of the right eye.

Operation. No definite mass could be felt in the orbit. Through dissection and retraction of the orbital contents a bulging, bluish, thin-walled unencapsulated nonpulsating mass of definite proportions was seen behind the globe.

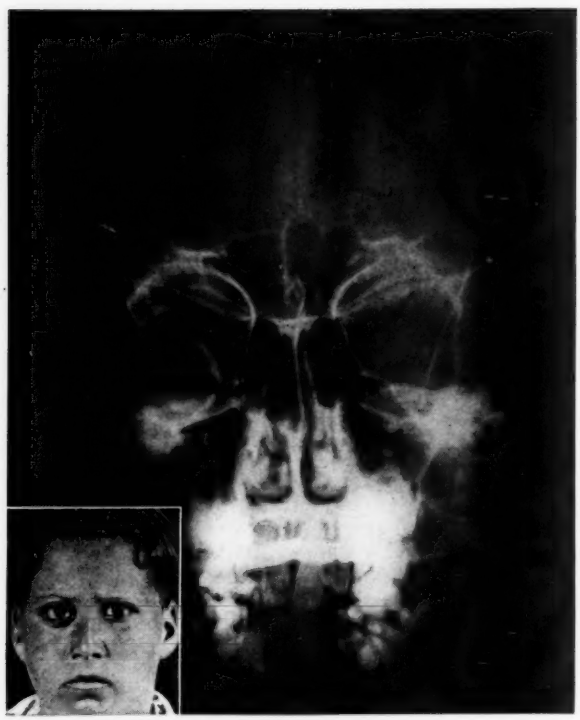

Fig. 21 (Pfeiffer). Case 15. Dermoid cyst of orbit (inset). Roentgenogram showing bean-shaped sharply circumscribed defect or fossa, with increased density of the marginal bone in the lateral wall of the right orbit.

A portion of this mass was excised, and free bleeding occurred, as if from a vein.

Discharge diagnosis. Venous angioma.

7. Oculomotor paralysis

In the many cases of oculomotor paralysis that came for roentgenographic study there were no positive roentgen-ray findings. In these cases the paralysis was associated with double vision, and there were no symptoms other than the exophthalmos of from 1 to 3 mm. Cases of saccular aneurysm of the circle of Willis, and those in which there was restriction of motility of the eyeball associated with other findings, were not grouped under this heading. Many cases classified as oculomotor paralysis improved, and many were never diagnosed etiologically. Neurologic studies were made of all the cases, and several were found to have intracranial lesions.

8. Dermoid cysts of the orbit (including two oil cysts and one teratoma)

These congenital cysts usually lie superficially in the orbit and, according to the literature, are rarely retrobulbar. In all the cases in the present series the eye was displaced anteriorly, and sometimes to one side, by the lesion. In several instances at operation the walls of the lesions were so thin that it was doubtful whether enough tissue of the desired type could be secured to send to the laboratory for histologic study.

These growths, especially when situated deep in the orbit, are associated with defects in the bone which are fairly characteristic. Well-defined, sharply circumscribed fossae, or indentations, or even hiatuses, may be found in the bone with margins of increased density.

One patient with exophthalmos exhibited the typical defect of a dermoid in the lateral wall of the orbit in the X-ray film, and at operation was found to have a cyst containing sebaceous material. This was diagnosed tuberculosis, the diagnosis being based on the histologic study of a small piece of tissue of the wall in which giant cells were found.

CASE 15. DERMOID CYST. The patient, H B., a boy, aged 11 years, had had a variable right exophthalmos for 1½ years; there was no pain nor distress of any kind.

Examination. A solid right exophthalmos of 7 mm. was revealed, without any restriction of motility and no diplopia. The visual acuity of each eye was normal, and the fundus of the right eye showed 1 diopter of papilledema, together with several small hemorrhages.

Roentgenographic report read in part as follows: "The capacity of the right orbit is slightly greater than the left, with more concave and slightly thinner walls. The sphenoid ridges and lines of the temporal fossae are nearly symmetric. The superior orbital fissure of the right orbit is slightly larger than its fellow of the other orbit. A striking, rather bean-shaped fossa, measuring approximately 1½ by 3 cm., is present in the lateral wall of the right orbit, between the temporal line and superior orbital fissure. The margins of the defect are sharp and the bone at the margins is slightly increased in density in places. The bone of the floor of the fossa is very thin, but complete, so that there is no communication with the middle cranial fossa. The optic canals are circular in contour, measuring 5 mm. in diameter, and are symmetric. All of the paranasal sinuses are nearly symmetric (fig. 21).

"Impression: The sharply circumscribed character of the defect of the lateral wall of the right orbit and slight increase in density of the surrounding bone is characteristic of a dermoid cyst."

Operation. Through a lateral-canthotomy incision the lateral wall of the right orbit was

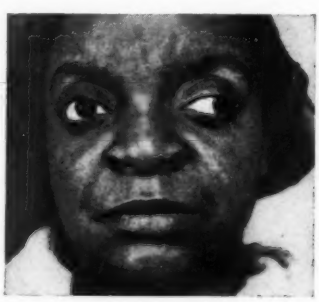

Fig. 22 (Pfeiffer). Case 16. Dermoid cyst of the orbit.

well exposed. A firm, grayish mass, 2 cm. from the margin of the orbit and anterior to the apex, extending from the roof to the floor, was revealed, with a low ridge of surrounding bone. The soft structures of the orbit were not involved. On attempting to loosen the mass from the fossa in the bone in which it lay the wall burst, and a large quantity of oily fluid poured from the opening. The incision was then enlarged, and the interior of the cyst was nicely viewed and treated with phenol and alcohol without touching the soft tissue of the orbit. After this treatment as much of the cyst wall as possible was removed.

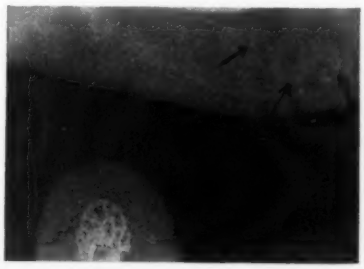

Fig. 23 (Pfeiffer). Case 16. Bone-free roentgenogram of mass in the upper left brow, showing a well-defined shadow of diminished density of fat or cholesterin, and indicating a dermoid cyst.

The following case is an example of the use of bone-free films in the study of superficial lesions of the orbit:

CASE 16. DERMOID CYST OF THE ORBIT. The patient, S. C., a colored woman, aged 36 years, complained of a lump below the left eyebrow in the eyelid, which in recent years seemed to have been getting larger (fig. 22).

Examination. A palpable, firm mass was revealed anterior to the left lacrimal gland which seemed to be adherent to the periorbita of the lateral wall. There were 50 centrads of left exotropia, and the exophthalmometer showed 1 mm. of left exophthalmos. The eyeball was replaceable.

Roentgen examination of the orbits revealed these structures to be perfectly normal and symmetric. A bone-free film of the palpable mass in the upper left eyelid showed a well-defined circular defect of diminished soft-tissue density suggesting fat (fig. 23).

Impression: The shadow on the bone-free film is that of a dermoid cyst.

Operation. A cyst was found adherent to the periorbita anterior to the lacrimal fossa. During the dissection the wall ruptured, and a yellowish oily fluid was liberated. The cyst wall was then dissected away.

Histologic diagnosis. Dermoid cyst of the orbit.

9. Sarcoma

There were 8 cases of unilateral primary sarcoma of the orbit: 2 cases of fibrosarcoma, 2 of lymphosarcoma, 2 of rhabdomyosarcoma, and 2 of extraocular extension of sarcoma of the choroid. In all of these the exophthalmos was severe and in most cases it was of long standing—from two to 20 years. In most cases the eye was displaced solidly forward, with restriction of motility.

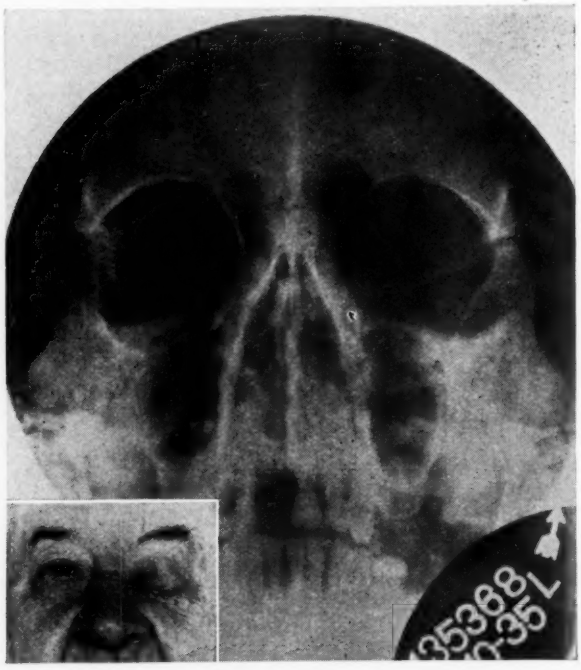

Fig. 24 (Pfeiffer). Case 17. Fibrosarcoma of the orbit (inset). Roentgenogram showing enlarged left orbit with atrophy of the walls, especially of the roof, due to increased intraorbital pressure.

Roentgenographic examination revealed that increased intraorbital pressure was present in all cases, and in several it reached an extreme degree, as in the case described below. In one instance there was an enlargement of the superior orbital fissure, and in another invasion and destruction of the bone of the outer wall occurred.

Case 17. Sarcoma of the orbit. The patient, A. Z., a man, aged 75 years, came for treatment of the left orbit because of more or less continuous headache. Twenty years ago a tumor, was removed from the left orbit, and subsequently the globe was extracted. In recent years the socket had been observed to fill up, so that an artificial eye could not be worn.

The diagnosis made at the first hospital was fibrosarcoma of the orbit.

Examination. The left orbit was filled with solid, unyielding tissue. The cul-de-sacs were obliterated, and the lids were fixed in position. No nodes were palpable in neck or in front of left ear. The right eye was normal objectively, and had a vision of 20/20.

Roentgenographic report was in part as follows: "The left orbit shows increased soft-tissue density and an inordinately severe degree of increased intraorbital pressure. The walls of the orbits are thin, the roof being remarkably so, with an apparent hiatus in the center. The left optic canal is not enlarged, but seems to be shortened. The right orbit is perfectly normal in appearance (fig. 24).

"Impression: The extreme degree of increased intraorbital pressure in the left orbit with the apparent dehiscence in the roof, is indicative of an intraorbital tumor, probably a sarcoma, of long duration."

Operation and course. During the process of exenteration of the orbit the opening through the roof was revealed, there was loss of cerebrospinal fluid, and death followed on the third day.

Pathologic diagnosis. Fibrosarcoma of orbit.

10. Neurofibromatosis

The occurrence of seven cases of neurofibromatosis of the orbit in the present series would seem to indicate that it is not a rare condition. In all seven cases marked deformities of the bony orbit were revealed by the roentgen ray. In six there was massive overgrowth of the fibrous tissue in the upper eyelids with ptosis. These masses of tissue continued to grow and, when excised, they tended to recur.

The roentgenographic findings in these cases are most striking. In two instances

the bone separating the orbit from the intracranial cavity was lacking, so that intracranial pulsations were transmitted to the contents of the orbit causing pulsating exophthalmos.[39] In one of these cases the optic canal was entirely absent, although the eye had fair vision. In both cases the affected orbits were much larger than normal and the adjacent paranasal sinuses were encroached upon and were smaller. In two of the seven cases the intermarginal dimensions were greatly increased, and in one of these the superior orbital fissure was many times the normal size, and the optic canal measured 11 mm. in diameter. This latter case was reported by Dr. Wheeler,[23] because of the interesting buphthalmos in which fibromatous tissue was found in the choroid. In the remaining three cases the orbital margin above was rounded off in a manner that is found associated only with neurofibromatosis. Five of the cases showed striking enlargement of the optic canal, suggesting

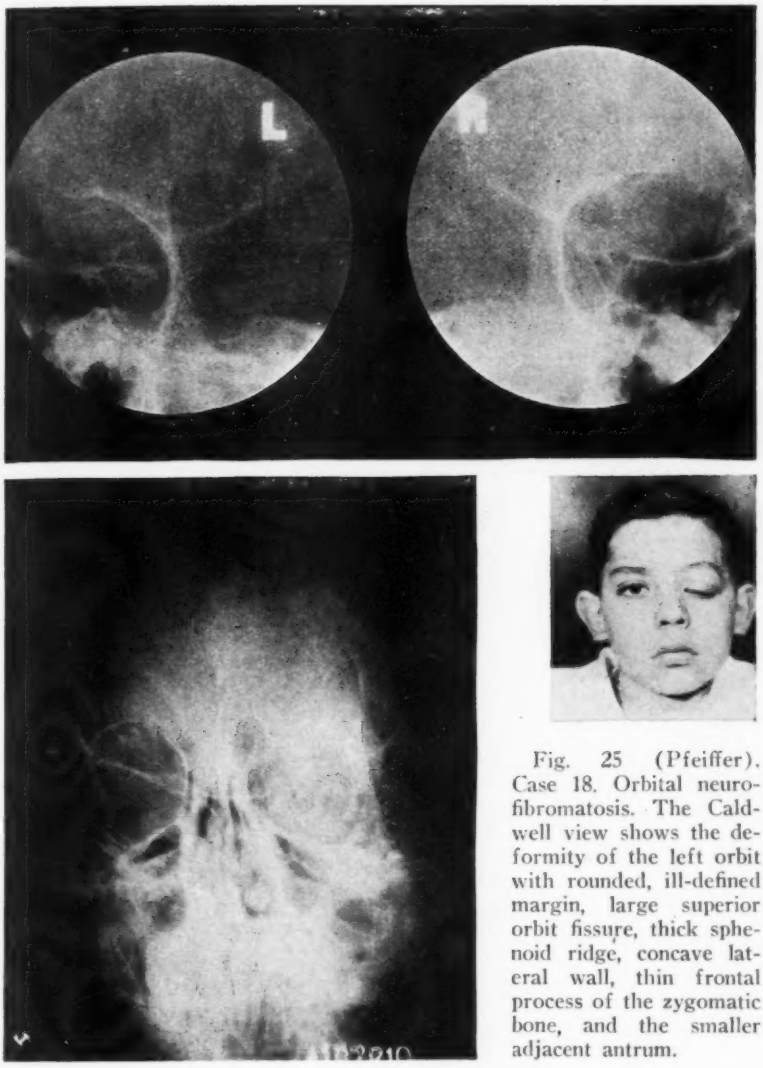

Fig. 25 (Pfeiffer). Case 18. Orbital neurofibromatosis. The Caldwell view shows the deformity of the left orbit with rounded, ill-defined margin, large superior orbit fissure, thick sphenoid ridge, concave lateral wall, thin frontal process of the zygomatic bone, and the smaller adjacent antrum.

involvement of the optic nerve or its sheaths with neurofibroma. Since the field of vision of three of these patients was normal, it did not seem likely that glioma of the optic nerve was present. The following is a typical case:

CASE 18. NEUROFIBROMATOSIS, GENERALIZED AND ORBITAL. The patient, B. S., a boy, aged 12 years, had an internal strabismus which was corrected some years before, the boy's parents stating that a drooping of the eyelid appeared soon after the operation. Recently lumps had developed on his body. There was no evidence of similar disease occurring in family. The mother was an epileptic.

Examination. There was 3 mm. of left exophthalmos, with restriction of elevation and depression and without pulsation. The globe was replaceable. The upper eyelid was greatly thickened and drooped 4 mm. The eyeball showed a posterior lens opacity, a normal fundus, and a vision of 20/100.

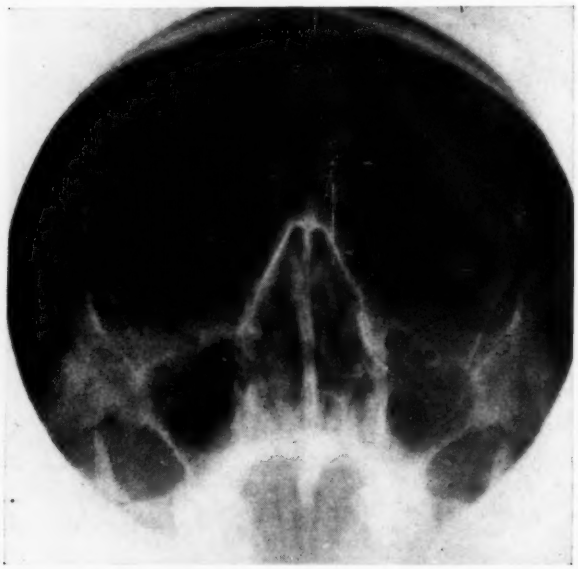

Fig. 26 (Pfeiffer). Case 19. Asymmetry of antra and orbits. Roentgenogram showing smaller left antrum, together with depression of floor of orbit into the sinus, which shows walls of increased density.

Roentgenographic description of orbits was as follows: "The right orbit is altogether normal in appearance. The left orbit shows a number of unusual variations and is small. The margin is quite irregular and ill defined, especially above, where it is rounded off. The superior orbital fissure is much larger and the sphenoid ridge is thicker. The optic canals are asymmetric. The right canal is oval in contour and measures approximately 3 by 5 mm., while the left is roughly triangular in outline and measures approximately 5 by 6 mm. The left paranasal sinuses are smaller than the right (fig. 25).

"Impression: The small and unusual left orbit is a congenital anomaly associated with neurofibromatosis."

Operation. Dissection of fibrous tissue from the upper lid and correction of ptosis.

Pathologic diagnosis. Neurofibromatosis.

11. DEFORMITY OF THE ORBIT

Asymmetry in the sizes of the orbits, other than that observed in craniostenosis, may be responsible for exophthalmos. Although it may seem to be a matter of enophthalmos, because of the prominence of one eye the condition is usually regarded clinically as exophthalmos. In three cases in the present series the asymmetry appeared to be due to underdevelopment of one maxillary sinus. The antra of these sinuses showed thickened walls, suggestive of suppurative sinusitis, which had been present in early life, and which had produced osteitis with subsequent retarded development of the maxillary bone. In two cases the intermarginal dimensions of one orbit were greater, but there was no apparent enlargement of the cavity itself and the calvaria were normal. In two cases there was frank traumatic enophthalmos. The following is a report of one of these cases:

CASE 19. ASYMMETRY OF ANTRA AND ORBITS. The patient, E. M., a woman, aged 44 years, when she was examined for glasses was observed to have a prominence of the right eye. Her husband had noticed the condition for a number of years and feared that a tumor was the cause. She had had numerous attacks of sinusitis, the first many years before. There was no history of injury.

Examination. There was 2 mm. of right

exophthalmos, which could be reduced by pressure. There was no diplopia or limitation of motility. The corrected visual acuity, the fundi, and the visual fields were normal.

Roentgenographic report read in part as follows: "There is some asymmetry of the margins of the orbits, and the walls of both are normal in appearance. The sphenoid ridges and temporal lines are symmetric. The left sphenoid fissure is slightly larger than the right. The floor of the right orbit bulges upward posteriorly in a normal fashion. The floor of the left orbit is depressed into the antrum. The optic canals are normal in size and contour, and are symmetric. The left antrum is much smaller than the right, shows increased density of the wall, which indicates chronic osteitis, and the sinus itself is clouded. All the rest of the paranasal sinuses are of average size and are clear.

"Impression: The floor of the left orbit is depressed into the antrum, probably by fracture which occurred early in life. In addition, the sinus is smaller than the right and shows increased density of walls, suggesting osteitis."

This is a case of left enophthalmos which was mistaken clinically for right exophthalmos.

(To be concluded)

OPHTHALMIC PRISMS, SOME USES IN OPHTHALMOLOGY*

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NEUROPHYSIOLOGIC CONCEPTS WHICH EXPLAIN THE USE OF PRISMS

Before studying some uses of prisms in the diagnosis and treatment of oculomotor disturbances, it might be well briefly to review several facts concerning projection correspondence, reciprocal innervation, and synkinesis to demonstrate that there are definite physiologic bases which justify the use of prisms and which will aid in the prescribing of these specialized glasses.

PROJECTION

The first of these physiologic facts is projection. It depends upon the visual line for the accurate localization of external objects. This theoretical or imaginary visual line extends from the object fixated through the nodal point to the macula of the fixating eye. Duane[1] has clearly expressed the law of projection: images of objects impinging upon the macula are projected outward as if on a line passing through the nodal point of the eye. Images of objects impinging upon the retina below the macula are projected upward; if above, they are projected downward; if nasally, outward; if temporally, nasalward. Normally, therefore, any object whose image impinges on a point on the retina is projected to a point in space directly opposite.

As projection is dependent upon the visual line and influences the proprioceptive and motor impulses from the ocular muscles, and as a prism *apparently* deflects objects toward its apex, then in certain cases the line of vision can be varied by prisms so as to influence the proprioceptive impulses and the other abilities of the eyes. These effects can be produced in both comitant strabismus and paralytic deviations.

How can the monocular line of fixation be varied by a prism, and how can monocular projection explain the cause for the apparent displacement of objects toward the apex of a prism?

If the letter E is viewed six meters from the eye through a prism of one diopter, light rays from the letter are

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* From the Department of Ophthalmology, Children's Memorial Hospital. Presented before the Chicago Ophthalmological Society, on November 16, 1942.

deflected toward the base of the prism. But this apparent displacement of the E toward the apex when viewed through the prism occurs because mentally the deflected images are projected outward along the visual line. This deflection is directly proportional to the strength of prism, the index of refraction, and the distance from the eye of the object fixated. The apparent deviation increases progressively one centimeter for each one meter of the object's distance from the eye. This fact, that a prism deflects objects a greater amount at distance than at near, compels the ophthalmologist to determine the deviation at distance fixation in prism diopters by means of the cover test and to prescribe this amount of prism if necessary.

Therefore, the fact that objects are deflected toward the apex (if understood clearly) aids us in comprehending the physiologic properties of prisms. Hence, strictly speaking, the apex of the prism is, clinically, the active part. Thus the eyes follow the apex even when fusion is broken and diplopia occurs (except when severe suppression ensues and one eye diverges from binocular fixation).

As with monocular projection, binocular projection is essentially innate, and is dependent upon the fact that certain parts of the retinas possess corresponding areas, sensations from which are experienced as one object in binocular distance fixation.

As with monocular projection the maculas are the primary points from which other areas assume directional values. The two maculas are intimately associated, so that if one visual line is deflected by the apex of a prism which does not break fusion, the visual line of the fellow eye is deflected in a similar direction.

These corresponding areas, however, are not absolute and become reorganized in some cases of squint so that the two maculas are no longer the primary points of reference to each other. Instead, the macula of one eye in these cases becomes associated with reference to an extramacular area of its fellow eye. This is termed abnormal correspondence. The afterimage test, in such cases, discloses the presence of an abnormal correspondence. Here prisms are less effective than in the presence of a normal correspondence. But in treating motor defects in patients possessing normal correspondence, although amblyopia is present, prisms may be used to shift the field of vision in any direction desired if fusion between the two eyes is not disrupted.

For patients who have eccentric fixation, however, prisms are said to be in most cases useless. Yet I wish to suggest their use in attempting to treat this condition nonsurgically.

Projection, therefore, is a valuable ally of the ophthalmologist when he prescribes prisms in treating motor anomalies.

RECIPROCAL INNERVATION

A second neurophysiologic fact that aids us in understanding the action of prisms was presented experimentally by Sherrington and Leyton[2, 3] in 1893—that of reciprocal innervation and reciprocal inhibition. He showed that electrical stimulation of the cerebral cortex of apes produced coördinated movements of the eyes toward the opposite side of the body —the agonists contracting, the antagonists relaxing. The eyes in adult human beings are no exception to these observations and to the rules of reciprocal innervation. For example, when one wishes to move his eyes to the right a motor cortical impulse is sent through the subcortical pathways to the association areas in the pons, thence to the right external rectus and left internal rectus to contract. Meanwhile, a reciprocal impulse is sent to the right internal rectus and the left

external rectus, causing them to relax gradually. In this manner the movement of dextroversion is accomplished in a symmetric synchronous rotation without loss of comitancy or of parallelism between the two eyes. The neurologic fact of reciprocal innervation explains how prisms placed before one eye will influence not only the line of vision of the eye behind the prism, but also the visual line of the fellow eye, even if the fellow eye be amblyopic. This monocular prism will cause one muscle to contract and the opponent of this muscle to relax. Therefore, in a paresis of the right external rectus muscle, a prism, base out, properly applied before the left eye, will induce a relaxation of the opponent of the right external rectus (the homolateral right internal rectus) and will aid in reorganizing the motor and the proprioceptive ability of such eyes. In these instances, diplopia is not always the cause of the nausea and headaches, but rather it is the proprioceptive disorganization that causes these symptoms.

Reciprocal innervation, therefore, like projection, is another ally of the ophthalmologist in the effective use of prisms.

SYNKINESIS

The third neurophysiologic concept effecting and affected by prisms is synkinesis. Synkinesis is defined[4] as "(1) an associated movement; (2) an unintentional movement accompanying a volitional movement." It is classified as "(1) imitative synkinesis, which is an involuntary movement on the healthy side accompanying an attempt at movement on the paralyzed side; and (2) spasmodic synkinesis, a movement on the paralyzed side attending voluntary movement on the healthy side."

Returning to the example of dextroversion (previously used) to demonstrate synkinesis—as one moves the eyes to the right side, the right eye may move upward or downward, but the right inferior rectus muscle prevents abnormal amounts of elevation; the right superior rectus prevents abnormal amounts of depression. The obliques, meanwhile, prevent abnormal amounts of torsional movements when the right eye is in the position of abduction.

A similar situation exists in the left eye when it is in the position of adduction. The left superior oblique prevents an abnormal amount of elevation of the left eye; the left inferior oblique prevents an abnormal amount of depression; while the recti of the left eye prevent abnormal torsions. All of these muscles, therefore, act to produce the symmetric concomitant movement of dextroversion. Ophthalmologists refer to the correlated coöperative actions of all these muscles as synergetic actions, and the muscles thus cooperating are called synergists. These actions, however, are termed by many neurologists normal synkinetic actions.

In most children below 12 years of age and in some adults examples of abnormal synkinesis, both spasmodic and imitative, are frequently found. Many of these abnormal movements of the eyes occur in patients who have supranuclear paresis of the muscles. In these children the extraocular muscles exhibit marked spasticity when the eyes are used binocularly so that many lower motor-neuron lesions are simulated by these spastic lesions. Most of such patients exhibit a spastic overaction of the inferior obliques and the internal recti, but there is no paralysis of the contralateral superior rectus or of the homolateral superior oblique. The cortex in such patients is defective in action either through injury or arrest of development. Because of this defect in function, the centers for oculomotor correlation either escape from normal cortical control, or have never been subject to it. As a result, they are influenced by subcortical levels and do not control cor-

related movements of the eyes as in the normal person.

When the cover test is used with prisms to measure quantitatively the squint in prism diopters, one finds the deviation becoming more and more severe, reaching as much as 100$^{\Delta}$ at times. Then, suddenly the spasticity decreases. Before the spasticity decreased, 100$^{\Delta}$ was required to stop the movement of the eyes under the screen. This movement, after the spasticity has decreased, may possibly be stopped by 20$^{\Delta}$.

Clinically, the considerable overaction of the inferior obliques, in such cases, decreases or disappears when prisms of moderate degree are worn, base out, before both eyes for several months.

A second example of abnormal synkinesis occurs in abducens pareses in children. For example, in a paresis of a right externus a right esotropia occurs. But if the child fixates with the right (paretic) eye, a secondary deviation of the left eye is observed. Likewise, in these cases, some of the excessive impulses to maintain the position of the right eye in fixating pass to the left inferior oblique, producing a left hypertropia in the normal left eye. In such cases, a prism placed base out before the left eye shifts the field of the normal eye toward the right, the right internus relaxes, and the right externus requires less stimulus to abduct the right eye. In such cases the left hypertropia will often decrease in amount when prisms, base out, are placed before the left eye.

Hering's law

This brings us to the fourth observation to be discussed—Hering's law, which states that a motor impulse sent to one eye is ultimately distributed equally to the two eyes.

This law explains the secondary deviation in paralytic squint. It also explains how the impulses produced by a prism before one seeing eye is likewise referred in an equal amount to the fellow eye. A 20$^{\Delta}$ lens placed base out before the right eye should deviate the object fixated toward the left 20 cm. at one meter's distance, with the right eye moving toward the left at an appropriate distance. This occurs momentarily with diplopia and blurring. Then the left eye follows the right to resume binocular fixation. The amount of fusional amplitude will cause a variation in such a horizontal physiologic test.

Prism therapy

With these remarks concerning the physiologic bases for the use of prisms, their detailed application will be discussed.

Briefly the treatment by prisms of paralysis of divergence, concomitant esotropia, and paralysis of the external rectus muscle will be considered.

What is a prism? In answer to this question, an ophthalmic prism may be defined[5] as a thin, wedge-shaped, transparent medium of plastic or glass, the index of refraction of which is usually about 1.52. It has two nonparallel polished plane faces, called the refracting surfaces (where light rays are refracted), and an angle called the angle of refraction. In this discussion the term prism will be used in a restricted sense to refer only to those specialized prisms used in ophthalmology as aids in the diagnosis and treatment of motor disturbances and anomalies.

In contradistinction to a prism, which, strictly speaking, is not considered a lens, in optics the word lens denotes a portion of a transparent substance, usually isotropic, comprised between two smoothly polished regular surfaces, both curved or one curved and one plane. A lens as defined, therefore, does not include a

prism; yet if a prism is ground with a toric surface, it fulfils the definition of what is called a lens. It seems, therefore, that the definition of what comprises a lens must be changed or else toric prisms should be accepted as lenses.

A number of types of ophthalmic prisms should be familiar to the ophthalmologist. Round prisms, those found in the trial case, range from a 1 prism diopter to 20 prism diopters. Even if one uses a phorometer, these loose, round prisms are of value when it is desired to determine a patient's ability to read with lenses, which (newly prescribed) all too often incorporate within them an undesirable vertical or horizontal prismatic deflection. Such a prescription was presented recently as a problem. The patient, aged 65 years, had never worn bifocals comfortably. She required a R. −5.00D. sph. ⌯ −0.25D. cyl. ax. 90° for 20/50 vision and L. −.50D. sph. for 20/30 vision, with an added +3.00D. for both eyes. She had lenticular opacities and an arteriosclerotic retinopathy, both of which could explain the poor vision. When she looked at the visual-acuity chart located 20 feet away, she could see comfortably. But when she attempted to read at 14 inches she experienced a pulling sensation in her left eye, associated with epiphora and pain. A round, loose prism of four prism diopters, base up, before the right eye relieved these symptoms for near vision. She read for half an hour with comfort. I know of no other method by which one could determine the *functionally* correct prism which would be required to relieve her symptoms. Her final prescription, therefore, was R. −5.00D. sph. ⌯ −0.25D. cyl. ax. 90°; L. −0.50D. sph., a slab-off right lens, and an added +3.00D. for both eyes.

The overlapping diplopia at the reading distance, which the lenses in the case just cited induced by their base-down effect, was four prism diopters. In the right eye the prismatic effect, eight millimeters below the optical center, was four prism diopters, base down; in the left eye it was 0.4 prism diopters, base down. This prismatic effect was equalized by the optician, who removed the excess prism, base down, in front of the right eye. This process is called slabbing off by the optician.

In addition, these round prisms can be used in a trial frame when attempting the screen test, the Maddox-rod test, and in measuring diplopia within narrow limits in adults who have motor defects which disorganize binocular single vision. They can be inserted in the frame and rotated to induce a vertical diplopia to test a patient for diplopia who complains of a total visual loss, but who is malingering. Similarly, they can be used in the von Graefe test to measure the type and quantity of heterophorias.

In addition to round prisms, rectangular or square prisms are used when making the quantitative screen test, if it is performed in the diagnostic positions of gaze, and if a vertical and a horizontal deviation are to be measured simultaneously or consecutively. In addition, a patient can hold a horizontal prism, base out, in front of his eyes while the vertical deviation is measured, and the head-rotation tests are made to determine the variation of the vertical component when the head is tilted and rotated in different directions.

Rotary prisms likewise have especial places in the diagnostic field. They can be used in measuring the so-called ductions, in measuring the deviation when the Maddox rod is used, and in measuring quantitatively by means of the screen test the deviation in the diagnostic directions. The rotary prism especially may be combined with the square prisms in measur-

ing simultaneously and consecutively vertical and horizontal deviations when employing the screen or cover test.

Besides the round and square prisms with flat sides, there are toric prisms with curved sides. These are especially valuable when inserted in fitovers, or hook fronts, as therapeutic tests to determine the ability of a patient to tolerate prisms. These prismatic lenses can be used only by patients who will tolerate them. Many such patients when wearing the fitover prisms will learn to suppress the asymmetry of objects and metamorphopsia produced by the prisms, and will develop good fusion as the ocular deviation improves. In patients who have asthenopic symptoms caused by stress on the fusion apparatus, the subjective sensations induced by the heterophoria will be decreased when the proper corrective prism is used. If, however, a patient suppresses vision severely, or has a fluctuating type of anomalous correspondence, he will not so certainly be relieved by prisms as will one who has good fusion and constant normal correspondence. But the prescribing of prisms, either for temporary or constant wear, must be based upon sound physiologic grounds, and not upon any mechanistic theory.

Three types of esotropia will be cited in which treatment with prismatic lenses, base out, was employed, and in which the subjective symptoms lessened and the horizontal deviation decreased.

Therapeutic use of prisms in convergent strabismus

divergence paralysis

The patient, J. H., a man, aged 42 years, was first seen on March 26, 1942. He complained of homonymous diplopia when looking at distant objects. The squint had followed an attack of influenza two months previous to the examination. The diplopia did not increase in gazing toward the right or left and decreased as the object fixated was brought toward him.

Ophthalmic examination. The screen test and the red-glass diplopia test revealed a convergent squint of 20$^{\Delta}$ when the patient fixated the Snellen E chart 20 feet from the eyes. The near point of convergence was 19 cm. At one meter's distance from the eyes, binocular vision was present. The diplopia could be relieved by wearing 16$^{\Delta}$, base out, in fitovers. Peripheral and central fields were normal. The serologic tests and urine were within normal limits. The glasses prescribed by cycloplegic refraction were R. +0.50D. cyl. ax. 180° for 20/13 vision; L. +0.50D. cyl. ax. 30° for 20/13 vision. The diagnosis was divergence paralysis following influenza.

Therapeutics. At the first examination fitovers were loaned: R.E. 2$^{\Delta}$, base out; L.E. 14$^{\Delta}$, base out. The patient had some diplopia at distance fixation, but this gradually decreased so that in two weeks he was given R.E. 10$^{\Delta}$, base out, and L.E. 1$^{\Delta}$, base out. One month later (April 25, 1942) he could superimpose the distant E with R. 2$^{\Delta}$, base out, and L. 2$^{\Delta}$, base out. These prisms were loaned to him for one month. The screen test then revealed an esophoria of 3$^{\Delta}$ at far and near. The Maddox rod revealed an esophoria of 7$^{\Delta}$ at far and an esophoria of 3$^{\Delta}$ to 6$^{\Delta}$ at 14 inches from the eyes.

At the present time the patient is visually comfortable. He has improved to the point where he has an esophoria of 1$^{\Delta}$ at 20 feet and an exophoria of 1$^{\Delta}$ at 14 inches.

Summary. A case of divergence paralysis is presented in which recovery was effected with the use of prisms to develop fusion and fusion amplitude, after

which the prisms were gradually reduced and then removed. At the present time the patient has 1$^{\Delta}$ of esophoria for distance, and 1$^{\Delta}$ of exophoria at 14 inches. He has good binocular vision without any prisms. The fitover prisms were reduced over a period of two months, so that the fusional amplitude (divergence ability) improved.

Criticism. In criticism of this therapy it is invariably suggested that such a patient would recover anyway, and that this case report proves nothing. This may be true, but such criticism can be presented in almost any discussion of cases in which control tests are obviously impossible. Nevertheless, the patient was comfortable while recovering; in cases where lost time is of permanent importance this treatment with prisms is of indisputable value.

CONCOMITANT ESOTROPIA

A second type of horizontal deviation decreased by prisms is concomitant esotropia. The deviation should be measured by holding prisms, base out, before the deviating eye and observing the movement of this eye while the fixating non-deviating eye is occluded. The movement of the deviating eye to fixate, in the case to be discussed, can be corrected by 25$^{\Delta}$, base out. Instead of discussing one patient with concomitant esotropia, it might be well to present three possible methods for prescribing prisms to treat these motor defects. The choice is offered of prescribing prisms to correct the total amount of esotropia (25$^{\Delta}$ in this instance), to overcorrect the deviation, or to undercorrect the squint.

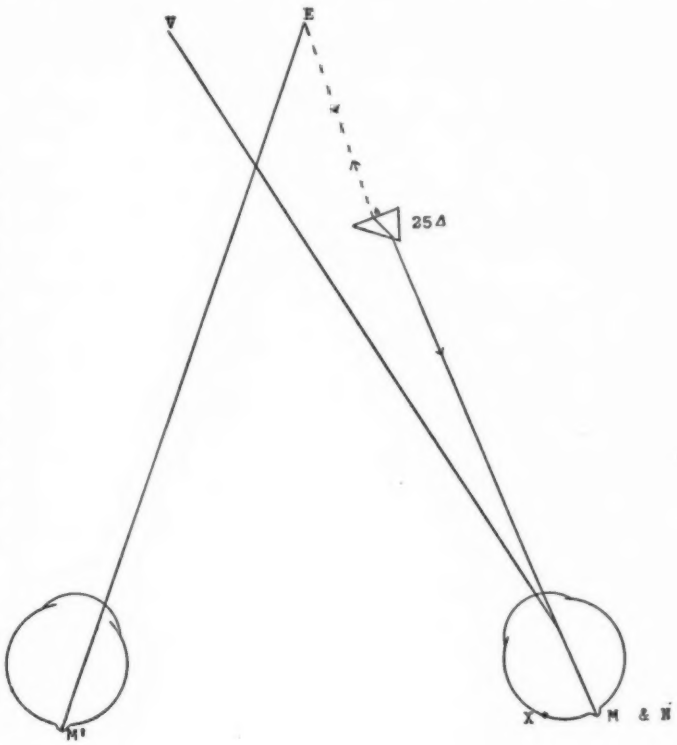

Fig. 1 (Guibor). Diagrammatic illustration: Total correction of right esotropia of 25$^{\Delta}$. This method improves binocular vision but does not improve the deviation (right esotropia 25$^{\Delta}$). Note rays from E, which would strike a point on the retina at X are deflected so that they strike the macula at M. Projection is therefore at E, along the line EM. VM is the actual direction of the visual axis of the right eye. EM′ = visual axis of the left eye. M′ = macula, left eye.

Correction of the total deviation by prisms (fig. 1). The amount of this eso-

tropia is determined by observing the nonfixating eye behind the prism and occluding the fixating eye, thus measuring the deviation with prisms, base out. By this means the esotropic deviation is presented. The movement of redress measured in this manner usually is determined within 0.5Δ. The wearing of this amount of prism has a tendency to stimulate binocular single vision, but it will rarely improve the strabismus unless the prisms are reduced gradually to undercorrect the squint, as was done in the previous case report of divergence paralysis.

Overcorrection of the deviation by prisms (fig. 2). Some examiners employ the Maddox rod to determine the amount of esotropia without determining the strabismus by means of the screen test, or by means of the red glass, measuring the diplopia with prisms, base out. Such a method with the rod measures not only the total deflection (esotropia and esophoria) but in addition stimulates the accommodative convergence. The latter fact will at times, especially for near fixation, present the examiner with a greater amount of *apparent* convergent squint than actually exists if the screen test is used to measure the esotropia. Therefore, if one prescribes prisms, base out, of the amount necessary to superpose the rod on the light, the convergent squint is usually overcorrected, thereby increasing the deviation by developing the fusional amplitude in the direction of the deviation. But this fusion amplitude should be developed in the opposite direction in order to decrease the deviation. In such cases the examiner finds the squint increased by prisms and concludes that

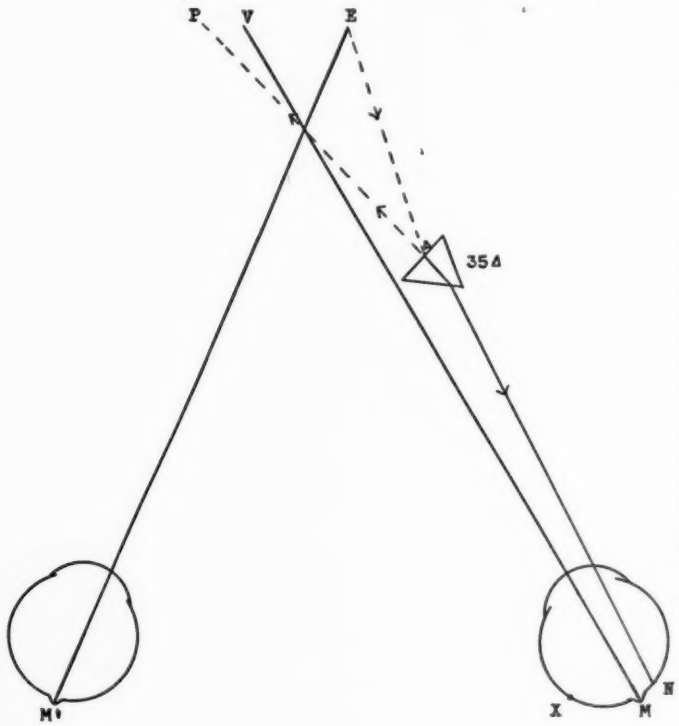

Fig. 2 (Guibor). Diagrammatic illustration: Overcorrection of a right esotropia of 25Δ. The deviation has been determined by the Maddox rod, which stimulates accommodation and convergence and therefore may present a subjective deviation greater than that deviation determined by the screen test. Note that the area N, near the macula, will stimulate the perimacular part of the retina temporal to the macula. This will cause the posterior pole to rotate temporally, the anterior pole nasally to superpose rays from the point E. The strabismus will therefore be increased by such treatment. Note that point P, and line PΔ crosses the normal visual line, which is projected normally to the point V.

prisms increase *all* deviations, and that prisms are ineffectual in treating motor defects. Actually the diagnostic quantitative measurement determined by the Maddox rod presented an abnormal amount of deviation. The deviation should have been measured by the screen test while the patient fixated the E chart at a distance of six meters. Then the deviation should have been undercorrected by at least five prism diopters.

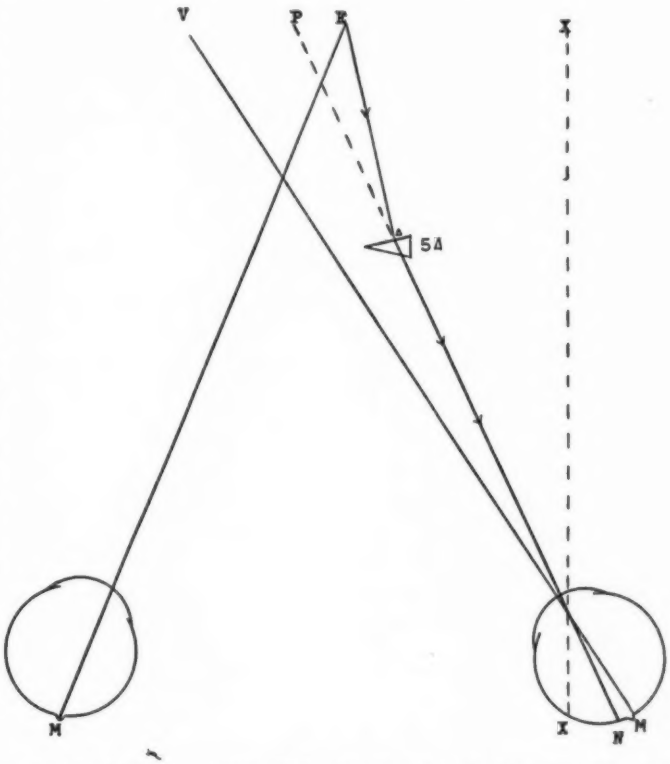

Fig. 3 (Guibor). Diagrammatic illustration: Undercorrection of right esotropia of 25Δ. Line of projection is dotted line (PΔ). M = macula; N = new area stimulated by the rays from E; X = portion of retina stimulated by E, before prisms. XX′ is old line of projection before use of the prism. VM = visual line R.E.; EM = visual line L.E. This is the best method of treating comitant motor deviations. The area N, is the part stimulated by insertion of the prism. The area X, the part stimulated by rays from E, before the use of prisms far removed from the macula compared to N, therefore stimulates less than N. The posterior pole must move nasally, the anterior pole temporally to secure binocular vision. Note P. The new point of projection is brought closer to the real object fixated (E).

Undercorrection of the deviation by prisms (fig. 3). A third choice is to undercorrect the deviation determined by means of the screen test. At this time one point must be emphasized, that a strabismic deviation is diagnosed by the observer placing prisms over one eye, and occluding the fellow eye until the esotropic eye no longer moves temporally to fixate the object. This is the manifest deviation under discussion, and not the total deviation composed of the esophoria and the esotropia. The latter is determined by measuring the deviation while alternately occluding the eyes of the patient as prisms of varying strength are held, base out, over one or both eyes to reduce the movements of redress to 0.5Δ.

If diplopia can be induced with the red glass, it too may be measured with prisms, base out, and the distance between the diplopic images can be determined in prism diopters. In such cases one reduces this measurement three to five prism diopters and prescribes this amount of prisms in the loose fitovers. A general rule is never to prescribe prisms in glasses until a therapeutic test has been made with the fitovers.

When this method of correcting deviations is employed, binocular vision de-

velops, and the esotropia frequently decreases. The maximum total which I have employed in such cases is 40Δ. If binocular vision develops well, and especially if the esotropia is of a spastic (supranuclear) type, the deviation may disappear after six months. This method of prescribing prisms for cases with esotropia, is, I believe, in proper cases, far superior to any fusion exercises that can be employed, since these prisms constantly worn during the waking hours constantly stimulate binocular vision; whereas fusion training with the major amblyoscopes or the stereoscope can be employed for relatively very short and intermittent periods of time. This technique of undercorrecting the deviation when prescribing prisms is considered the most ideal and efficient of the three methods of using prisms that are at the disposal of the ophthalmologist.

PARALYSIS OF THE EXTERNAL RECTUS MUSCLES

The third type of patient with an esotropia who can be aided by prisms properly prescribed is one with an abducens paralysis. When such a catastrophe as an external-rectus palsy suddenly befalls a person, the disorganized proprioceptive sense causes a greater discomfort than the attendant diplopia. This assertion can be proved if one studies a patient with a divergence paralysis in whom little or no proprioceptive disorganization seems to exist. The diplopia present causes some discomfort, but there is rarely the vertigo, nausea, and vomiting which occur in cases of a lower motor-neuron paraly-

CHART 1

SUGGESTED NONSURGICAL TREATMENT OF RIGHT ABDUCENS PALSY

Problems Involved	Treatment Suggested	Probable Results
1. Limit suppression of R.E.	1. Occlude L.E. constantly for one week while wearing prism over R.E. (see 2).	R.E. begins to fixate. L.E. converges under cover (secondary deviation).
2. Improve proprioceptive disorganization (nausea, headache, vomiting).	2. Prism base out over R.E. enough to overcome diplopia for distance less 1/3. L.E. occluded.	Proprioceptive disorganization decreases. Metamorphopsia produced by prism over R.E. Head rotation slight.
3. Decrease vicarious head position.	3. As 1 and 2.	Head rotation improves, but persists slightly.
4. Overcome diplopia.	4. As 1 and 2.	Diplopia persists when occluder over L.E. is removed, but decreases with head rotation to the right while wearing prisms.
5. Relax opponent (right internal rectus).	5. After one week, 5 prism diopters base out over L.E.	Binocular field shifted to right and right internus relaxes.
6. Improve synergist. At times spasm of superior rectus occurs.	6. See 2 and 5.	Dissociated vertical divergence frequent during this period.
7. Limit false projection.	7. See 1 and 2. After three weeks increase prism over L.E., if necessary. Continue occluding L.E. four hours a day for two months.	Less discomfort.

Superior rectus = a synergist in abduction and in preventing extorsion of paretic eye.

sis such as that associated with a palsy of the external rectus muscle.

Paralysis of a right external rectus muscle with its attendant diplopia and vertigo can be relieved easily by occluding the paralytic eye in which there is the primary deviation. The patient becomes a monocular individual. Macular suppression is developed, the internal rectus, which is the opponent to the paralytic externus, contracts severely, while the paralytic externus relaxes and atrophies. The convergent squint, a symptom of the paralytic externus, becomes severe and the patient has an eye that is useless for practical purposes, and that is, in addition, a disfigurement.

An alternative method of treating such a case is possible if the problems involved are recognized, and if the patient is willing to coöperate by wearing prisms and by occluding the *nonparalytic* eye.

Chart 1 outlines these problems as (1) the limiting of suppression in the paralytic eye; (2) the improving of proprioceptive disorganization; (3) decreasing head rotation; (4) reducing the diplopia; (5) preventing contracture of the internal rectus; (6) lessening contracture of the synergists; and (7) decreasing the intensity of false projection. The treatment suggested to overcome the suppression of the paralytic eye is that used for amblyopic squint; namely, to occlude the *nonparalytic* eye. This occlusion temporarily causes more discomfort because of the proprioceptive disorganization, discloses the severe secondary deviation in the *nonparalytic* eye behind the occluder, but compels the palsied eye to fixate. There is, however, a valuable ally to lessen the severe vertigo and headache caused by occluding the nonparalytic eye; namely, a prism, base out, over the paralytic eye. The chart suggests that the proprioceptive disorganization be improved by placing over the paralytic eye a prism, base out, just strong enough to overcome diplopia less 10^{Δ}. The patient can cope with this amount of discomfort by rotat-

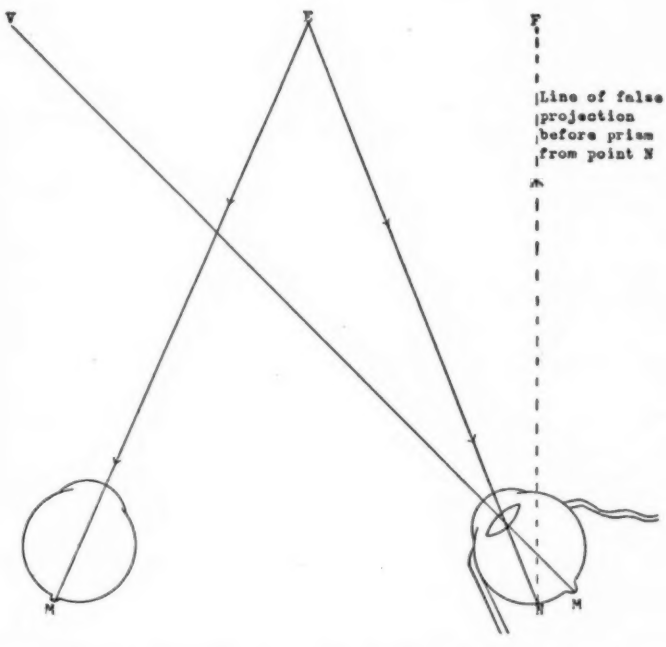

Fig. 4 (Guibor). Components of right abducens palsy. Diagrammatic illustration to represent some of the components of a right abducens palsy. M = macula; VM = visual line of right eye deflected to left of fixation object E; EM = visual line of left eye; N = extramacular area stimulated by rays from E, which are projected to F. Line of false projection = FN. Note relaxed right externus (paretic), and contracted right internus.

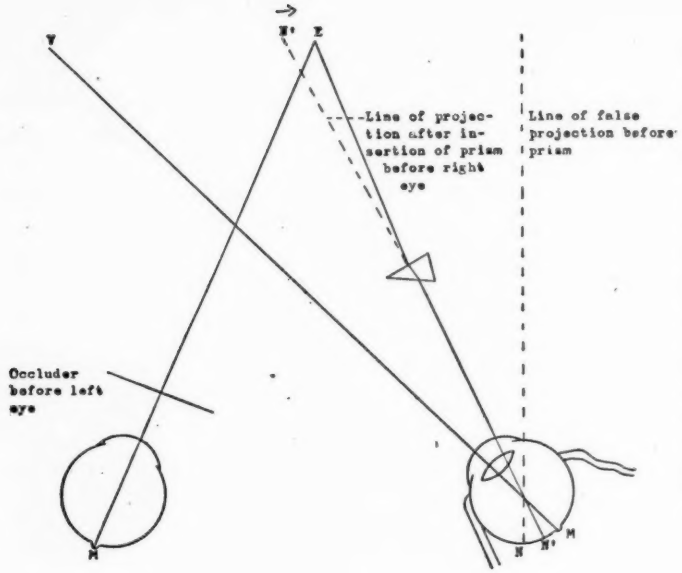

Fig. 5 (Guibor). Components of right abducens palsy. Stage 2 in treatment of right abducens palsy. Prism base out before right eye and occlusion before left eye. M = macula. N = extramacular area stimulated by rays from E before the use of prisms. N′ closer to macula than N. N′ new point of stimulus after use of prisms. N′ is projected closer to E, the point fixated by left eye than was the area N. This will have a tendency to decrease proprioceptive disorganization and to relax the internal rectus. Occlusion of the left eye prevents suppression of the right eye.

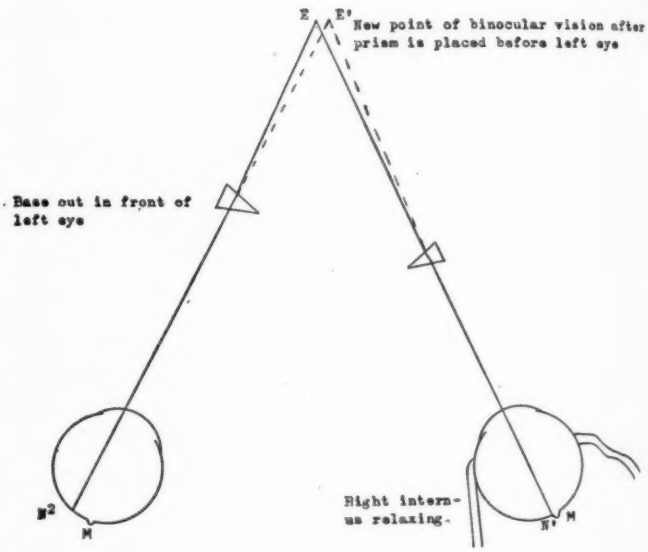

Fig. 6 (Guibor). Components of a right abducens palsy. Stage 3 in the treatment of right abducens palsy. A prism is placed base out before the left eye and the prism base out before the right eye is decreased. This displaces the object fixated, E, toward the right to E′. This relaxes the right internal rectus and may allow binocular vision. Note that the posterior pole of the right eye must turn nasally, the anterior pole temporally, and that the posterior pole of the left eye must turn temporally in order that N^2, the new point of stimulus produced by the prism base out before the left eye, may fall upon the macula, M, of the left eye. This throws the binocular field toward the right.

ing the head. As much as 35$^{\Delta}$ may be prescribed over one eye, and most patients will wear these prisms (figs. 4, 5, 6). After one week the occluder is removed from the nonparalytic eye and diplopia recurs. If suppression of the paretic eye reappears the nonparalytic eye is occluded for one-half day every day for an additional two weeks.

The problem of relaxing the opponent to the paralytic externus (the internus) may now be considered (figs. 4, 5, 6). Gradually the prism before the paralytic eye is reduced, and that before the non-

paralytic eye increased until the lesser amount of prism is before the paretic eye. Reciprocal innervation, a second ally, enters the picture to compel the right internus to relax, even though the external rectus remains paralytic. The convergent squint caused by the paralysis will decrease in amount, and will be inconstant in character, so that there will be some rotation of the paralytic eye outward.

I have seen severe abducens palsies from syphilis and from multiple sclerosis disappear with this type of treatment (and without this type of treatment, but not so completely). I have seen a left abducens palsy, the result of a skull fracture, improve from an esotropia of 50 degrees to one of 5 degrees. This method of using prisms in treating paralysis of an externus is of value, but will not always replace surgical procedures.

Summary

1. The action of prisms when placed before the eyes can be explained by the known physiologic phenomena of projection, reciprocal innervation, and synkinesis.

2. Prisms are of value in the diagnosis and treatment of motor disturbances produced by anisometropia and neuromuscular defects. The types of prisms most commonly used are the round, the square, the prism rack, the rotary, and the toric.

3. The nonsurgical treatment by prisms of divergence paralysis, concomitant convergent strabismus, and abducens paralysis is discussed, with figures to explain how prisms are applied therapeutically.

4. It must be understood that prisms are prescribed only after a therapeutic test is employed with the fitovers. They should be prescribed on a neurologic and physiologic basis and not on mechanistic theory alone.

Lack of space makes necessary the omission of descriptions of their detailed use in the diagnosis of motor disturbances by the screen test, their detailed optical characteristics, and their therapeutic uses in other motor anomalies, such as horizontal conjugate paretic deviation, supranuclear paresis of elevation, exotropia, and the like.

It is a pleasure to thank Dr. Richard Gamble and Dr. Douglas Buchanan for their assistance in the preparation of this paper.

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COLOBOMA OF THE OPTIC NERVE*

Report of a case

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San Francisco

Coloboma of the optic nerve unassociated with defects of the surrounding choroid is a rare occurrence, only about 50 cases of this condition having been reported in the literature. Of the various theories propounded as to its pathogenesis the most widely accepted is that of von Ammon.[2] It explains the optic-nerve coloboma as being due to a defective closure of the fetal cleft of the optic cup in its extreme posterior portion. Associated with this anomaly is an abnormal development of the surrounding mesoblastic precursor of the choroid and sclera, with ectasia of the resulting cicatricial tissue. This view has been confirmed by the experiments of von Hippel[15] and, more recently, by the observations of Nicholls and Tansley[23] on rats, and of Payne[25] on the human embryo.

In coloboma of the optic nerve the disc varies greatly in size from practically normal dimensions to as much as 20 times the normal measurements. Usually it is two to four times larger than the normal size, and may be round or vertically oval. In most cases the region of the disc is occupied by a deep excavation, which may resemble a marked glaucomatous cupping. This excavation is more pronounced in the inferior portion of the disc, and its color may vary from grayish white to the more frequently seen dull bluish pink without the mottling characteristic of the lamina cribrosa. The margins of the disc are usually surrounded by a glistening whitish ring which is irregularly and sometimes excessively pigmented. The distribution of the vessels, the most distinguishing characteristic, is highly variable, the entrance of the vessels often lying elsewhere than in the nerve-fiber mass. According to Caspar,[6] the arrangement of the vessels in coloboma of the optic nerve may be classified in three groups: (1) cases in which all the vessels emerge from the lower portion of the pseudodisc, even those which later turn upward; (2) cases in which the vessels emerge at or a little above the center, their arrangement being almost normal; and (3) cases in which the vessels emerge at the circumference of the disc and appear to bend sharply around its edges. The vessels in the latter group are sometimes referred to as cilioretinal vessels.

The vision may be normal, but is usually seriously defective. In some cases it may be reduced to mere perception of light. Coloboma of the optic nerve is usually unilateral, but instances of bilateral occurrence are not uncommon and have been reported by Calhoun,[5] Adler,[1] Johns,[17] and others. In the case of bilateral coloboma, one eye is usually blind, while the vision in the other is nearly normal, although in the case described by Adler the vision was normal in both eyes. The defect in the visual field varies in extent from corresponding enlargement of the blindspot to concentric contraction. Other gross defects, such as contraction of the upper portion of the field or a centrocecal scotoma, may be present. As in most cases of congenital malformations, other abnormalities, such as holes in the disc, cysts of the optic-nerve sheath, persistent hyaloid artery, and coloboma of

* From Greens' Eye Hospital.

the choroid lens, or iris may be associated with the coloboma of the optic nerve.

REPORT OF CASE

A white youth aged 20 years, reported to the clinic for examination on March 17, 1942. He stated that the vision in his left eye "was always low, and it crossed" when he was a child. The family history and the past medical history were essentially irrelevant.

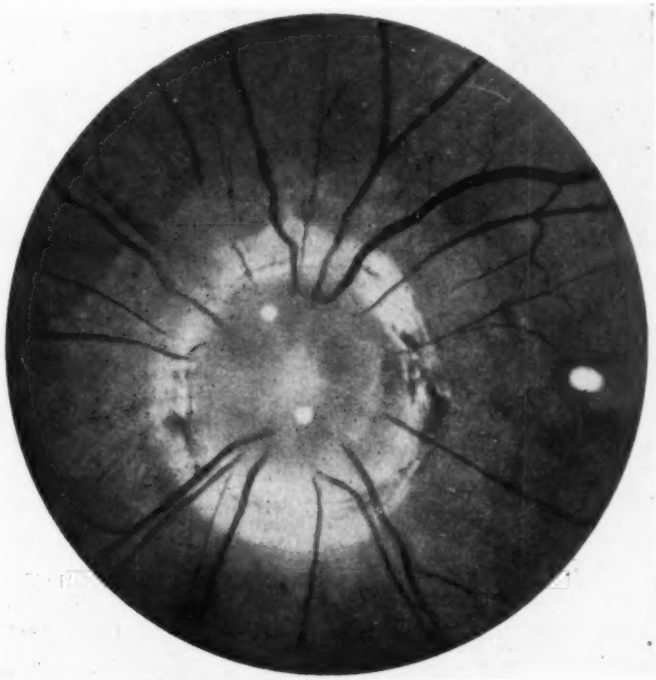

Fig. 1 (Steinberg). Photograph of fundus of left eye, showing coloboma of the optic nerve.

Examination. The vision in the right eye, uncorrected, was 20/20 −3 and was improved to 20/20+4 with a +0.75D. cyl. ax. 10°. The vision in the left eye, uncorrected, was 20/200 and could not be improved with a lens, although skiascopy revealed a refractive error of a −1.00D. sph. ⌯ −1.00D. cyl. ax. 55°. The left eye manifested a convergent strabismus of 10 degrees for distance and for near. No nystagmus was present, and the ocular movements were normal. The eyes were of normal size. The pupils were round, regular, and equal, and reacted normally to light and accommodation. The irides were brown and normal in appearance. The intraocular pressure, tested with the Bailliart tonometer, was 16 and 17 mm. Hg for the right and the left eye, respectively. Fusion tests revealed almost complete suppression of the left eye, diplopia with false projection.

Ophthalmoscopic examination showed the media of the right eye to be clear and the fundus normal in all respects. In the left eye the media also were clear. The fundus was easily seen with a −1.00D. lens. The most striking part of the fundus was the pseudoöptic disc (fig. 1), which appeared to be about three times the normal size. Its center was markedly excavated, from −6.00 to −8.00D. The central portion was bluish gray, the periphery grayish white. The margins

were sharply defined, the temporal side showing a thin irregular ring of choroidal pigment. The vessels appeared to emerge at the borders and bend sharply at the edges, corresponding to group 3 of Caspar's classification. The vascular distribution from the margins out to the periphery was normal, and no lesions were noted in the periphery nor in the macula on gross examination.

Visual fields. The field of the right eye was essentially normal. The field of the left eye showed slight peripheral contraction on the perimeter. Projection of the visual field of this eye on a 2-meter screen revealed decided enlargement of the blindspot for a 10-mm. test object, corresponding to the area of coloboma, with a tendency to a temporal defect for a 5-mm. test object, and further reduction for a 2-mm. test object, especially on the temporal side (fig. 2). Fixation was good, and central fields for color were normal.

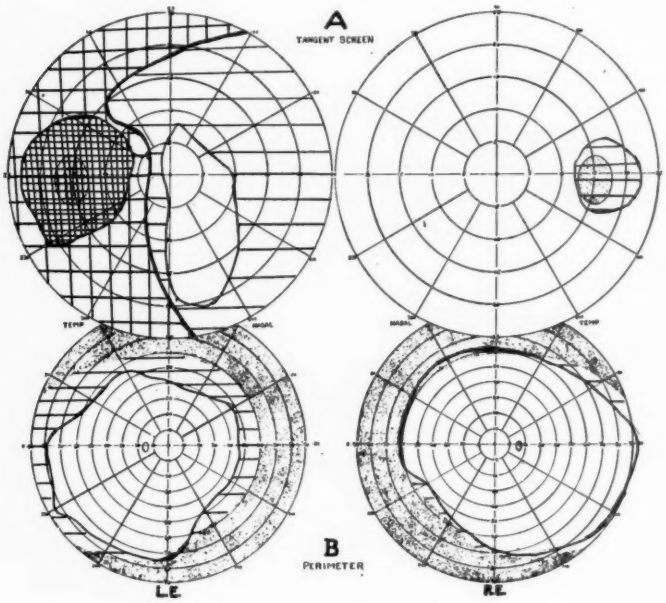

Fig. 2 (Steinberg). A, central fields as charted on the tangent screen. The heavily crossed area represents the field as charted with a 10-mm. test object, the lightly crossed area that charted with a 5-mm. test object, the horizontally shaded area that charted with a 2-mm. test object. B, the fields as charted on the perimeter with a 5-mm. test object.

Comment

This case is interesting because it presents most of the characteristics of coloboma of the optic nerve not involving the choroid. The increase in size and shape of the disc, the depth of the excavation, its striking bluish-gray color, the well-defined peripheral whitish margins, and the special disposition of the vessels were present in this patient.

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DERMATOLOGIC LESIONS ABOUT THE EYES*

Ocular pemphigus, Ectodermosis erosiva pluriorificialis, Triple symptom complex, Avitaminosis (ocular), Contact dermatitis (dermatitis venenata), Xanthelasma, Pseudoxanthoma elasticum and angioid streaks, and Lupus erythematosus (conjunctiva and lids)

Oliver S. Ormsby
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OCULAR PEMPHIGUS

The disease described under the title "essential shrinkage or shriveling of the conjunctiva" is considered synonymous with ocular pemphigus. It may occur independently or as a symptom of some other affection. It may be associated with a similar process in other mucous membranes. Klauder and Cowan[1] stated that "the term 'pemphigus of the conjunctiva' should be applied to a slow, progressive shrinking of the conjunctiva that occurs as a part of pemphigus of the mucous membranes." The term "shrinkage or shriveling of the conjunctiva" should be kept for those cases produced by some other diseases than pemphigus. The early symptoms of the disease consist of a catarrhal inflammation of the conjunctiva associated with a thick mucoid discharge. There is some burning and itching at this time. These symptoms may be recurrent over a period of years. At times the disease develops as a gradual shrinking of the conjunctiva without inflammatory symptoms and their accompanying subjective manifestations. In these, dimness of vision occurs through loss of transparency of the cornea. Vesicles and bullae are early manifestations and may occur on any portion of the cornea or conjunctiva. They are usually superficial and transitory and leave no sequelae. In the late atrophic stage they do not occur in these tissues, but do occur on other mucous membranes. At a later date the disease is "characterized by xerosis, chronic inflammation of the subconjunctival tissue that causes the conjunctiva to shrink, with the formation of scar tissue and symblepharon, and union of the palpebral conjunctiva with the conjunctiva of the bulb, producing ankyloblepharon, and the extension of a skin-like, horny membrane over the cornea, resulting in blindness." Vesicles and their sequelae involving other mucous surfaces or bullae on the skin may or may not be present. Klauder stresses the fact that the skin of the eyelids covers over the inner and outer canthi. "In the terminal stages the lids are fixed to the globe, and the cornea is covered with a skinlike membrane. Movement is restricted," and considerable pain may be present.

There may be associated keratitis, with development of vesicles, ulceration, perforation, or hypopyon. A vascular keratitis is often present and a pannus may cover the cornea. On other mucous membranes, which include the mouth, throat, nose, vagina, and anus, vesicles and erosions develop which in some situations terminate in ulceration and scar formation that produces shriveling, distortion, and partial obliteration of the involved areas. A common location for the last-named manifestation is in the nasopharynx, where cicatrization causes distortion. When the skin is involved there is a recurrent eruption of bullae usually limited to the face, including the eyelids. A sparse general eruption may be pres-

* Read before the Chicago Ophthalmological Society, on November 16, 1942.

ent. The disease usually occurs in later life. Acute cases in children are considered severe atypical forms of multiform erythema.

Slitlamp appearance. A number of interesting changes are shown by this method of examination, the description of which is given in the reference cited.[2]

The disease is *differentiated* from trachoma by the presence of lesions on the skin or mucous membrane, its slow progression, prolonged periods of remission, the absence of follicles or granules, the deep corneal infiltration and the benign type of pannus, the frequency and type of symblepharon, and later the ankyloblepharon and attachment to the cornea, and by the characteristic membrane covering the cornea. The course of the disease varies. It usually is very slow, lasting over a period of years with remissions and exacerbations. Blindness has ensued within two years in some cases. Shrinkage of the conjunctiva may occur in bullous dermatitis herpetiformis following vaccination. It has been recorded in conjunction with erythroderma ichthyosiformis. It has also been reported in association with epidermolysis bullosa dystrophica acquisita and congenital syphilis.[1]

ECTODERMOSIS EROSIVA PLURIORIFICIALIS

Under this title Klauder[2] described an affection which he considered a form of erythema multiforme. The disease was originally described in France as an entity. In this country it has been described by a number of ophthalmologists as a form of multiform erythema accompanied by severe ocular symptoms. It is characterized by an acute onset with fever and constitutional symptoms and an eruption that involves the extremities chiefly, together with stomatitis, conjunctivitis, and sometimes involvement of the mucosa of the nose, urethra, vagina, and anus. The constitutional symptoms consist of chills and elevation of temperature ranging from 102° to 104°F. together with headache and malaise.

Stomatitis, which may be severe, begins with vesicular lesions; as the inflammation increases a pseudomembrane is superimposed. Ulcers may or may not develop. The inflammation often extends to the throat and epiglottis. Profuse salivation is usually present.

Ocular symptoms are always prominent and may be so severe as to cause partial or total blindness. They begin with a vesicular bilateral conjunctivitis which in mild cases clears, leaving no sequelae. Inflammation of the nasal mucosa is present and is accompanied by epistaxis and crust formation. In the anogenital region a vesicular dermatitis occurs early, and may be followed by ulcers. All portions in these areas in both sexes may be involved.

After several days a multiform eruption, consisting of macules, vesicles, and purpuric lesions, develops on the hands and feet. In some areas the vesicles are grouped as in herpes, while in others erythematous lesions with vesicular centers resembling multiform erythema occur. These lesions terminate in crusting. The disease runs its course in from three to six weeks as a rule. Adenopathy is mild or absent. Relapses have been reported.

Diagnosis. The characteristic features of the disease are its constitutional symptoms and marked involvement of the conjunctiva together with the erythema multiforme symptom complex in the skin.

TRIPLE SYMPTOM COMPLEX

In 1940 Bencet[3] described a new disorder characterized by aphthous ulcers in the mouth, ulcerating lesions on the genitalia, and retinitis and iridocyclitis. In some of the cases lesions resembling erythema nodosum were present. The symptom complex is recurrent, runs an

indefinite course, and varies in severity. A virus infection is suggested as a possible cause. It is considered distinct from ectodermosis erosiva pluriorificialis, which it closely resembles. It also has to be differentiated from multiform erythema nodosum, and ulcus vulvae acutum.

AVITAMINOSIS (OCULAR)

The chief vitamins deficiency of which causes ocular and cutaneous symptoms are vitamin A and vitamin G (B_2), riboflavin.

A clinical syndrome presenting symptoms in the skin and mucous membranes including the eyes was described by Frazier and Hu[4] from observations made in clinics in China. The association of nyctalopia (night blindness), keratomalacia, and a follicular hyperkeratosis is now a well-recognized syndrome due to deficiency of vitamin A. In these cases the skin was described as being dry and roughened and presenting firm conical and hemispherical pigmented papules. Horny plugs or spines projected from hair follicles. The normal lines of the skin were exaggerated, producing a wrinkled appearance. Perspiration was reduced. The eruption was usually generalized, but occasionally it remained localized in special areas. Loewenthal[5] made similar observations in soldiers in East Africa. There was association of night blindness, xerophthalmia, and follicular hyperkeratosis. In all of these cases both the ocular and cutaneous symptoms cleared up upon the use of cod-liver oil.

The best sources of vitamin A are butter, cream, egg yolk, fish-liver oils, and green leafy vegetables.

Sebrell and Butler[6] described a symptom complex due to riboflavin deficiency which at times had associated ocular lesions. In most cases there was a perlechelike eruption at the angles of the mouth, a scaly inflammation of the vermilion portion of the lips, together with a mild, greasy, seborrhealike dermatitis in the nasolabial folds and at the inner and outer canthi of the eyes. At times this dermatitis was more extensive. At times there was a fissure at the muco-cutaneous junction of the nares and a magenta tongue. Sometimes these cases presented a vascularizing keratitis. This causes photophobia, dimness of vision, circumcorneal injection, and burning sensations of the eyeball. Corneal opacities and iritis may occur.

Keratitis and conjunctivitis are quite often associated with rosacea and are examples of a riboflavin deficiency. Kissmeyer[7] states that both the bulbar and palpebral conjunctivas may be the seat of dilation of vessels and diffuse inflammation often accompanied by a marginal blepharitis. Pinhead-sized grayish-red nodosities, prone to ulceration, occur chiefly at the bulbar angles. The corneal changes consist of a well-defined pannus composed of fine vessels extending from the margin toward the center of the cornea. A deep subepithelial grayish infiltration may occur on any portion of the cornea. Ulcers preceded by abrasions and accompanied by infiltration, and vascularization that may end in scar formation and impairment of vision occur in the epithelium.

Riboflavin in the dosage of 5 mg. thrice daily is efficient in clearing up these lesions.

Best sources of riboflavin are milk, eggs, liver, muscle, and yeast.

CONTACT DERMATITIS (DERMATITIS VENENATA)

A dermatitis occurring on the lids is one of the commonest affections seen by the dermatologist. The earliest sign in these cases consists of an erythema that is often limited to the lids but may extend to and involve other areas. There is ede-

ma with marked swelling, and on this reddened area vesicles and papules often develop. After several days involution occurs, with the formation of crusts or scales, and the process is over in one to three weeks. In the lacquer cases the lesions are usually erythemato-squamous rather than vesicular and in time the area becomes lichenified. The commonest cause of this dermatitis in women is the use of cosmetics, particularly nail polish. Very often when due to nail polish the face and neck and the area over the clavicles and around the ears may be involved in addition. There are many cases, however, in which the dermatitis remains limited to the lids, particularly the upper. Of 100 cases reported by Osborne, Jordan, and Campbell[8] lid lesions occurred in 78 percent. In certain cases the inflammation remains subacute over a long period and recurrences can always be traced to fresh contact with the polish. Nail polishes are very complex substances. The common base is cellulose nitrate or pyroxylin. These bases have a variable composition. At least 15 different solvents are used together with about 40 different plasticizers to give the polish flexibility. For coloring a sudan pigment and zapon-proof coloring substances are the chief pigments used, although 8 or 10 others are frequently incorporated.

Other sensitizing agents are present in proprietary hair dyes and hair lotions. The black dye termed Paraphenylendiamin, which is a constituent of the best black hair dyes, is exceedingly toxic. It is interesting to note that the contact dermatitis from ivy and primrose and other common irritants of that group do not attack the lids with the frequency of the dyes. When it has been proved that an external irritant is an exciting factor the management of the case becomes simple.

Therapy. Sodium thiosulfate may be injected in the dosage of one gram intravenously every other day for a week, together with a 10-percent naftalan ointment applied locally.

XANTHELASMA

In this condition the lesions are often limited to the lids. In some cases they may extend beyond this area for some distance. In a size ranging from pinhead to pea, or larger, they involve the upper lid at the inner canthus as chrome-yellow lesions that merge to form larger plaques which sometimes interfere with vision. In about 70 percent of the cases there is a moderate to marked elevation of blood lipoids, especially of cholesterol and total lipoids, but as a rule this elevation is not marked. An important feature of this condition which is not generally recognized is that it may be the first sign of an impending cardiovascular disease, hypertension, or arteriosclerosis.

Treatment. The management of xanthelasma is often unsatisfactory. If the skin is lax, complete surgical removal is efficient, although recurrences happen. The electric needle gives a fairly good result in some patients; in others refrigeration with carbon dioxide snow is efficient. Recurrences can be expected in a certain proportion of cases.

PSEUDOXANTHOMA ELASTICUM AND ANGIOID STREAKS

Pseudoxanthoma elasticum, first described by Balzar in 1884, was given its name by Darier in 1896 (see ref. 9). Hallopeau and Lafette first reported the simultaneous occurrence of pseudoxanthoma elasticum and angioid streaks in 1903. Grönblad in 1929 emphasized the association of the two conditions and in 1932 reported four cases, reviewed the literature, and made a comprehensive report of the conditions. In 1939 Sandbacha-Holstrom stated that in the reports of 100 cases of pseudoxanthoma elas-

ticum published during the 10-year period from 1929, associated angioid streaks of the eye were present in 87. While the association of the two conditions is common, either may occur independently of the other. Pseudoxanthoma elasticum presents discrete chamois-yellow to orange pea-sized papules which later assume a linear arrangement, or which merge to form plaques of various sizes. The disease usually originates on the neck or in the axillary folds and spreads to other portions of the cutaneous surface, especially the articular folds, cubital and popliteal spaces, and the groin. At times they are seen on the abdomen, about the umbilicus, on the thighs, back, genital regions, elbows, anus, and the dorsum of the hands. The palms and soles escape. The mucous membranes are occasionally involved. The eruption is symmetrically placed and presents no subjective symptoms. The disease occurs at any age and in both sexes. It usually is first seen in early adult life. There is often a familial history, inheritance being recessive in character. The disease usually persists throughout life.

Histopathology. The histopathologic changes is pseudoxanthoma elasticum are typical and diagnostic. There is basophilic degeneration of the elastic tissue in the midcutis separated from the epidermis by a band of normal connective and elastic tissue. The elastic fibers undergo swelling and granular degeneration, and there are fragmentation, splitting, and curling of the fibers. There is no merging of the elastic and connective-tissue fibers. Inflammatory changes are minimal, and occasionally a foreign-body giant-cell reaction is seen. Contrary to what was stated in earlier reports, the collagen fibers are unaltered. Calcification of the elastic tissue in a young patient was described by Friedman. Finnerud and Nomland have proved by staining methods, incineration, quantitative chemical analysis, and microchemical means that the degenerated elastic tissue is richly infiltrated with calcium and that the calcium is in the form of phosphate. In Balzar's case degenerative changes were found in the elastic tissue of the heart, an observation which emphasized the systemic nature of this disease.

Angioid streaks upon ophthalmoscopic examination appear as jagged irregular streaks which radiate from a peripapillary ring of the same nature. They lie deep in the retina beneath the retinal vessels and above the choroidal vessels, having no constant relation to either. The circumpapillary ring from which they radiate may be a gray zone around the disc which is more or less pigmented and associated with pigmentation of the margin of the disc or may have a whitish atrophic appearance. Rarely the streaks begin at a distance from the disc. The streaks may radiate like the spokes of a wheel or appear to branch and anastomose, giving the angioid appearance. The color of the streaks is usually described as brown or reddish brown. They also have been reported as red, black, gray-brown, lead colored, and, rarely, white. Angioid streaks vary in width from one-half to three or four times the diameter of retinal veins at the disc. Colored streaks are sometimes bordered by light-gray or white bands, on one or both sides, and there may be partial depigmentation along portions of the streaks. Angioid streaks are usually bilateral.

None of the histopathologic studies that have been made on angioid streaks have been accepted as explaining the nature of the lesions. Most investigators agree that pseudoxanthoma elasticum and angioid streaks present a clinical syndrome which apparently involves the elastin of the

skin and certain portions of the eye, Bruch's membrane, where there is a common degenerative process.

LUPUS ERYTHEMATOSUS (CONJUNCTIVA AND LIDS)

Lupus erythematosus sometimes occurs on the conjunctiva, the eyelids, and lid margins.[10] On the conjunctiva there is in the early stages, extreme redness with a velvetlike edema; also photophobia and a mucoid discharge. In the later stages well-defined, depressed atrophic areas develop. Occasionally these atrophic areas are linear in outline. On the lid margins there is redness and scaling with atrophic patches on the edge of the lids, which are dry and atrophic. They become rounded and soft and devoid of hairs. On the skin of the lids the lesions present the usual red, scaling well-defined patches which later become atrophic. The condition on the conjunctiva resembles trachoma but there are no vegetations nor follicles in lupus erythematosus. The chief diagnostic features in the conjunctival form are the violaceous color, edema, well-defined atrophic areas that develop later.

Therapy. Gold sodium thiosulfate is specific. This is given intravenously in the dosage of 10 to 50 mg. at weekly intervals. Bismuth by intramuscular injection in the dosage of 0.2 mg. is also very efficient.

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NOTES, CASES, INSTRUMENTS

REFRACTION CLINIC*

DISCUSSION BY DR. ALBERT E. SLOANE†
Boston

CASE 1

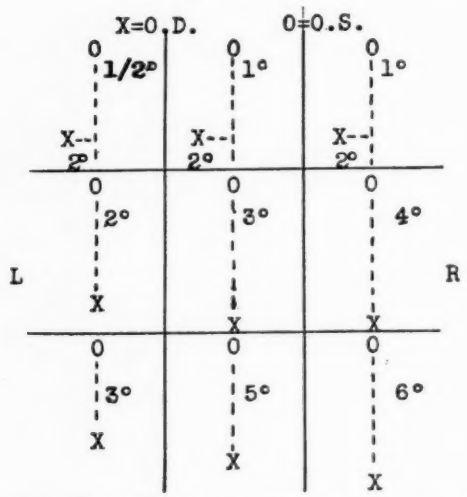
A man aged 24 years has had diplopia on looking down and to the right for the past two months. He has learned to see singly by keeping his head tipped downward. He does not see double looking straight ahead, but his eyes tire easily and become uncomfortable.

EXAMINATION

Vision was O.D. 20/40; O.S. 20/70. With a +2.00D. sph. ⊂⊃ −.75D. cyl. ax. 90°, it was 20/20, O.D.; +3.00D. sph. ⊂⊃ −1.00D. cyl. ax. 90°, 20/20, O.S.

Phorias: Distance, 6Δ R. hyperphoria (with Maddox rod before either eye); 2Δ esophoria. Near, 6Δ right hyperphoria; 2Δ esophoria.

Red-Glass Test with Maddox Cross at 2 Meters



X — O.D.; O — O.S. (Plotted in arc degrees)

DISCUSSION

Obviously the signs and symptoms are explainable on a binocular-imbalance basis. This is true because of the diplopia, the head-tilt, and symptoms. The refraction, even if not correct, would not have symptoms dating from such a definite time but would rather be more gradual, both in onset and course. The Maddox rod reveals right hyperphoria. The fact that the hyperphoria is the same when tested with the Maddox rod before either eye immediately eliminates alternating hypertropia, since in this latter condition the hyperphoria will be constantly present in the eye tested with the Maddox rod.

We can also rule out true hyperphoria because there is so much difference in the degrees of diplopia as disclosed by the red-glass test. True hyperphoria shows a practically constant amount of diplopia in all fields.

We are also able to rule out that form of hyperphoria that is caused by overactions of the obliques, since the patient has subjective double vision and the diplopia is not most marked in the field of the obliques. In hyperphoria due to overaction of obliques (congenital check-ligament deficiencies) there are no symptoms.

The diagnosis in this case is easily made by observing the diplopia fields. It is noted that the greatest field of diplopia is down and to the right, and that the ghost image belongs to the right eye. Since the depressor muscle in the right eye when looking down and to the right is the inferior rectus, it is in that muscle that the weakness lies. One asks the question, "Why is not diplopia constantly present in this case?" This may be answered by any of three, or any combination of these three, factors: (a) A strong

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fusion sense. (b) The compensatory head-tilt. (c) Suspenopsia. It is conceivable that the patient, by tilting his head, is using a field where the hyperphoria is small enough to be compensated by the fusion sense.

DIAGNOSIS

The diagnosis in this case is "paresis right inferior rectus muscle."

SOLUTION

The immediate management of the case consists of the following dispositions: First, a careful search for the cause; second, occlusion of one eye when the diplopia is disturbing; third, the use of glasses incorporating prisms either to neutralize or to reduce the amount of vertical imbalance. Occasionally, surgery must be resorted to, but it is always wise to wait a number of months before contemplating such measures. During this waiting period, prisms have their greatest use. In this case one can foresee considerable help with prisms because, first, the patient has learned to minimize his error by head-tilting, as evidenced by his lack of diplopia when looking straight ahead; and, second, his fusion sense must be quite sufficient to overcome the amounts of hyperphoria demonstrated. One is not likely to produce an artificial and symptom-producing left hyperphoria in the upper fields of gaze since the lids hide a good portion of the field.

I would suggest as a starter to prescribe a full correction with prisms of the smallest amount of hyperphoria in the horizontal positions of gaze. In this case, it would be 2 arc degrees, or 4D.; that is, 2D., base down, O.D., and 2D., base up, O.S. This would go far to neutralize the hyperphoria in looking straight ahead, to the right, to the left, and down to the left. It would also appreciably reduce the amount of vertical error upon looking straight down, and down to the right, so that the patient could accomplish overcoming the rest by a slight head-tilt and also by avoiding looking to the extreme right downward position. If the paresis tends to diminish as time goes on, the prisms may be discarded, first in one eye and then in both. On the other hand, if the paresis remains constant, it may be necessary to modify the correction slightly or keep it as is, depending upon the symptoms. If the paresis tends to increase, prisms may have to be increased, although it is not wise to consider correction with such lenses when the vertical deviation requires more than a total of 8D. Usually more radical measures are then indicated.

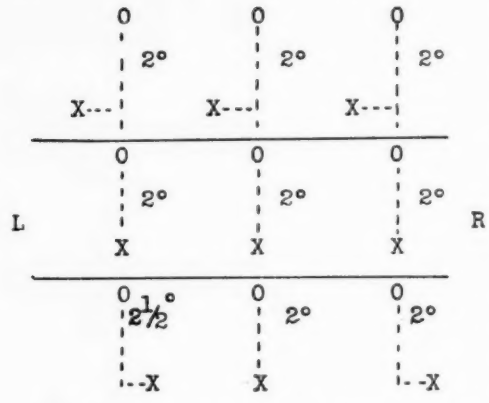
CASE 2

A girl, 24 years old, has had asthenopic complaints for the last four years. Her glasses have not helped her to obtain as much ocular comfort as she would like, and she has been labeled a neurotic. Her symptoms are more marked at far than at reading distance. She does not see double. She describes her greatest difficulty as a "tense pulling sensation" in the eyes. She has occasional nausea and this is always accentuated by riding in an auto or street car. She cannot walk up or down stairs without holding on to the railing, for she fears that she will fall. She is wearing: O.D. +1.50D. sphere; O.S. +1.50D. sphere, which "cuts down my sight so I will not strain my eyes."

EXAMINATION

Vision was O.D. 20/20; O.S. 20/20. With a + 1.00D. sph. it was 20/20 O.D.; with a + 1.00D. sph. it was 20/20 O.S.

Phorias: Distance 4^{Δ} right hyperphoria (with Maddox rod either over O.D. or O.S.); 2^{Δ} exophoria. Near, 4^{Δ} right hyperphoria; 10^{Δ} exophoria.



O — O.S.; X — O.D. (Plotted in arc degrees)

DISCUSSION

This young woman's symptoms may be explained in three general ways: 1. A problem of refraction. 2. A problem in ocular-muscle balance. 3. A problem not related to the eyes at all.

Let us first investigate the refractive state. Our examination discloses 1D. of simple hypermetropia. A patient of this age has adequate accommodation to compensate for this amount of error most of the time. Such an error, at best, is only productive of symptoms relating to accommodative effort. It was probably with this idea in mind that she had been overcorrected with plus lenses. The symptoms do not fit in well with a simple hyperopic error; therefore, in the correction one might as well give her the proper glass and good vision.

Let us consider the second approach. The Maddox rod reveals 4$^{\Delta}$ of right hyperphoria. This remains constant even when the Maddox rod is placed before the opposite eye. Thus we can assume that this is not an occlusion hypertropia (alternating hyperphoria). The diplopia field shows a fairly constant vertical diplopia of 2 arc degrees. This conforms favorably with the Maddox-rod findings, since 1 arc degree is equivalent to approximately 2$^{\Delta}$. This would tend to rule out a paresis of a vertical muscle. The fact that the near right hyperphoria is the same as for distance is another indication that we are dealing with a true hyperphoria rather than one of the other types. The lateral imbalance of exophoria is well within normal limits. Some of the commonest symptoms attributable to true hyperphoria are nausea, carsickness, and difficulty in judging steps. These symptoms are probably due to the fact that the amplitude of vertical fusion is relatively small and (under such circumstances) is taxed to the point of giving discomfort. Thus the most marked symptoms in vertical heterophoria may occur with small errors, since the large errors cannot be fused and the double vision is overcome by suppression of one eye. It is interesting to note that the near vision gave no symptoms. It is possible that she has learned to overcome her hyperphoria by unknowingly shading one eye while reading. This is a common practice among people with symptom-producing amounts of near heterophoria. Another possibility may be that the combination of 10D. of exophoria and her right hyperphoria are enough to have induced diplopia and subsequent suspenopsia at the reading distance. (This could easily be determined by using the bar test.)

Let us consider the third approach. Most of us believe that the diagnosis of psychoneurosis is too often a wastebasket diagnosis made in the absence of positive information. Since we do have findings consistent with the symptoms, it would be better to give the patient the benefit of the doubt. No doubt the hyperphoria was overlooked in her previous examinations, since her lenses carried no prisms and the accommodative factor was stressed.

SOLUTION

This is an admirable case for prism correction. I would prescribe one half of

the total hyperphoric correction. (This to be divided between the two eyes.) There will be no great discomfort with this correction, since the hyperphoria is undercorrected in every field of fixation, so that no opposite condition is introduced. The patient's refraction should be checked again in about six months, since the aim is to correct as much of the hyperphoria as is productive of symptoms, and if there are still some symptoms, a fuller prism correction may be ordered later.

TREATMENT

O.D. +1.00D. sph. ⌯ 1$^{\Delta}$, base down.
O.S. +1.00D. sph. ⌯ 1$^{\Delta}$, base up.

QUESTIONS

House Officer: Will the original hyperphoria change in amount after prisms are worn?

Dr. Sloane: Usually not. However, in some instances the basic underlying heterophoria is greater than the phoria tests disclose, and later becomes more manifest. In such cases one has the false feeling that the basic error has increased. Marlowe's occlusion technique in making manifest a greater heterophoria is based on a similar type of reasoning.

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FREE-FLOATING CYST OF THE ANTERIOR CHAMBER*

ORWYN H. ELLIS, M.D.
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Free-floating cysts of the anterior chamber are of rare occurrence, and to date only 21 cases have been reported. Cysts of this type in the eye, including those reported floating in the vitreous, total 34 cases.

Evans[1] in 1936 reported a case and completely reviewed the literature. The writers—Boch,[2] Lewis,[3] and Evans—who have made microscopic examinations of the cysts following surgical removal, agree that the wall appears to come from the posterior epithelial cells of the iris or pars iridis retina. Surgical removal has been necessary in some cases due to increased intraocular pressure and occasionally due to the large size of the cyst.

REPORT OF CASE

The patient, a white man, aged 22 years, was seen in November, 1942. He stated that for the past five years he had noted a small brown mass in the anterior part of his right eye. The size had not

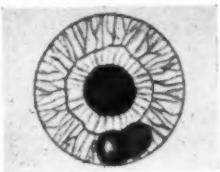

Fig. 1 (Ellis). Cyst at the 6-o'clock position.

changed, but he had noted that occasionally it disappeared and reappeared in one to three days. He has never had any pain or redness of the eyes, and only rarely did the mass come into the line of vision.

The past history and family history were without significance. Upon examination, the vision of each eye was 20/15, with a small refractive error. The left eye was without significant findings and the fundi were within normal limits. In the anterior chamber of the right eye was seen a small, round, brown mass about 3 mm. in diameter, freely floating in the aqueous. With the upright position of the head the mass remained in the vertical meridian at the 6-o'clock position. With lateral movements the position readily changed toward the horizontal meridian.

* Presented at the Los Angeles Eye and Ear Society, February 22, 1943.

Under the slitlamp and corneal microscope the body appeared to be translucent, and the granular appearance of the pigmented tissue was more clearly discernible. No precipitates nor cells were seen in or on the tissues lining the anterior chamber. There were no attachments to the iris.

Surgery was seemingly not indicated, except for cosmetic improvement, but the patient was advised to return for periodic examinations.

Duke-Elder[4] has stated that these cysts probably have two origins: (1) from remnants of the pupillary membrane and (2) from detached flocculi at the pupillary margin. The first case of this type reported in the literature by Businelli had a filamentary attachment to the pupillary margin, and microscopically showed tissue analogous to iris stroma. In other specimens examined microscopically the cells resembled those of the posterior epithelium of the iris.

In view of the appearance of this cyst and the benign character, this tumor should be classified as a free-floating cyst of the anterior chamber, probably originating from the posterior epithelium. The case is of interest because of the rarity of the condition.

Roosevelt Building.

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SOCIETY PROCEEDINGS

EDITED BY DR. RALPH H. MILLER

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 2, 1942

DR. JAMES W. SMITH, *presiding*

PHYSICS AND HISTORY OF ROENTGEN RAYS

DR. PAUL C. SWENSON discussed this subject during the instructional hour.

ROENTGENOGRAPHY IN OPHTHALMOLOGY

DR. RAYMOND L. PFEIFFER read a paper on this subject which will be published in this Journal.

TREATMENT OF MALIGNANT TUMORS OF THE EYE AND ADNEXA

DR. HAYES E. MARTIN showed lantern slides of various malignant tumors which occur in and about the eye, and discussed the general principles of treatment. He felt that many tumors of the eyelids were treated by too extensive and elaborate plastic procedures, when they might be better handled by radiation therapy. A thorough understanding by the surgeon of the morbid anatomy of the skin cancer involved would often save the patient from too radical a procedure and the loss of unnecessary amounts of healthy tissue. As for radiation therapy, in general he thought that there was sometimes a tendency to disregard untoward radiation effects in the eye and that when adequate protective shielding is impossible, surgery was the more desirable procedure in order to avoid ocular complications. He also stated that the possibilities of radiation as a treatment for tumors of the limbus is not sufficiently appreciated.

Discussion. Dr. Olga Sitchevska asked what the incidence of lens injury was in radiation therapy about the eye.

Dr. Martin answered that opacification of the lens was common in cancer clinics in cases in which cancer of the head and neck are treated with radiation. It is not always possible to avoid some irradiation of the orbit, and it is sometimes necessary to accept the lesser evil of ocular complications in order to control malignant tumors. Years ago when radon plaques were used for the treatment of facial skin tumors, cataract frequently followed. Because of this, it was necessary to change the technique of treatment and at the present time, soft X radiation is used and an attempt is made to shield the eye and avoid irradiation of the orbit.

X-RAY DIAGNOSIS OF INTRAOCULAR FOREIGN BODIES

DR. IRVING SCHWARTZ stated that radiographic localization of foreign bodies in the eye, is, in principle, simple, but requires painstaking attention to detail. Even to determine whether a foreign body is merely present requires the most rigid observance of certain precautions, and errors are not infrequent. Neglect of these precautions gives both false positive reports and false negatives.

The commonest error is the use of defective intensifying screens, and nearly all in use soon acquire defects. The shadow of a screen defect is indistinguishable from the shadow of a foreign body. Making several radiographs, especially in different projections, is not a safeguard, for it is easily possible to have similar defects in each of several screens projected in corresponding parts of the radiograph. Such defects may also lead to false negatives in that the shadow of a foreign body may be misinterpreted as

the shadow of a screen defect. To avoid this error, perfect screens must be used, but far safer is the employment of non-screen radiography. A second source of error is movement of the globe during radiography. The shadow of the foreign body is then blurred and can escape detection even if of considerable magnitude.

All injured eyes should be radiographed, even when the details of the mode of injury appear to rule out a foreign body as the cause. Cases were cited in which a foreign body was found after: 1. History of immediate removal (presumably a second foreign body). 2. Injury by a large stone missile (the patient's error—it had been a BB shot). 3. Injury by a snow ball. (No satisfactory explanation could be found.) 4. Enucleation following a stab-wound injury. (A large knife-blade fragment embedded in the frontal bone remained unrecognized and eventually gave rise to osteomyelitis.)

The numerous accepted methods of localization differ so little in inherent precision that a roentgenologist is likely to attain the best results by adopting one of these, learning it thoroughly, and employing it continuously.

Bone-free radiographs should be used to supplement any other method chosen, to reveal foreign bodies of low radiopacity.

Discussion. Dr. Edward Hartmann commented on the surprisingly early use of X rays by the ophthalmologists. In 1896, one year only after their discovery, X rays were being used in the search for foreign bodies of the eye and orbit, and a few years later, in 1899, Sweet had already devised a precise method of localization which is still in use and is one of the most accurate. This early employment of X rays in ophthalmology is surprising, since their use is attended by special difficulties. Foreign bodies are usually minute, and slight changes in orbital structures may not be easy to see on account of superimposed shadows that are cast by the skull and are difficult to exclude. Some of these difficulties can be eliminated by the use of stereoscopic views. He suggested that a diaphragm be used when looking at a picture on the negatoscope. This cuts out the bright surface which usually surrounds the film and helps bring out finer detail.

He advised against the use of X-ray and radiation therapy in cases of angioma of the lids. He reported the case of a four-year-old girl, in which the immediate cosmetic result was good following radiation therapy, but two years later she lost all the hair from the trigeminal region of the skull and her skin became thin and glossy over half of her forehead. The radium must have affected the supra-orbital nerve. Angioma is best treated by electrocoagulation or by the injection of sclerosing substances, as Dr. Martin suggested. He thought it more advisable not to treat papilloma of the conjunctiva and malignancies of the limbus with radiation, since protection of the lens is almost impossible in such cases and good results can often be obtained with electrocoagulation.

He commented favorably on the Sweet and Dixon methods of localizing foreign bodies. His experience with Vogt's boneless method had also been very satisfactory. He pointed out that in a lateral view half of the eye can be visualized with this technique and that even more can be projected on the film by the retrobulbar injection of 5 to 10 c.c. of normal saline. The Dixon technique is good but must be used by someone with a great deal of experience who is accurate in his measurements.

For a simple method, useful in military ophthalmology where complicated instruments are not available, he suggested Comberg's contact lens with four small inserted pieces of metal. He had used both

Comberg's technique and Vogt's boneless technique during the war in France and found them very satisfactory.

Sidney A. Fox,
Secretary.

WASHINGTON, D.C., OPHTHALMOLOGICAL SOCIETY

March 2, 1942

DR. E. LEONARD GOODMAN, *presiding*

RETINAL REST PERIODS

DR. STERLING BOCKOVEN read a paper on this subject and demonstrated a machine (the Fade-o-graph) which he had devised for measuring the time of such retinal rest periods.

CLINICAL PATHOLOGY OF THE CORNEA

DR. BENJAMIN RONES gave an interesting and instructive talk on this subject. The main function of the cornea, Dr. Rones said, is the maintenance of its transparency. The epithelium serves as an post of defense and is impervious to all organisms with the possible exceptions of the Gonococcus and the diphtheria bacillus. Bowman's membrane is probably a modification of stroma cells of epithelium. The stroma is made up of fixed cells and wandering cells, its integrity depending upon its water content. Fluids may pass through this membrane inward, but not outward. Fluid is supplied from the outside. It has normal respiration, oxygen passing in and carbon dioxide passing out.

He described Descemet's membrane as a tough structureless membrane. The endothelium is usually made up of a single layer of cells. The metabolism of the cornea is slow, and this predisposes it to allergic conditions. Anything that damages the epithelium or endothelium may upset the fluid intake and outgo. A good example of this is edema from injury. Repair of the epithelium can be rapid, the entire epithelium sometimes replacing itself in three days. If Bowman's membrane has been injured, repair is made by connective tissue and epithelium.

In inflammation, Dr. Rones stated, leucocytes, lymphocytes, and plasma cells are found in the structures of the cornea, producing a counter offensive. Repair follows with new blood vessels, fibroblasts, and scar tissue. Organisms do not pass through Descemet's membrane, but toxins do, and these may stimulate purulent exudate from the iris. Many of the reactions of the cornea are allergic and are secondary to toxins of infection elsewhere.

Microphotographic slides were shown to illustrate the conditions which Dr. Rones described.

COLOR SLIDES OF ANTERIOR EYE DISEASES

DR. RICHARD WILKINSON showed a series of colored pictures demonstrating external eye diseases, and gave a brief outline of his photographic technique.

SYMPATHETIC OPHTHALMIA

DR. HECTOR MCKNEW presented a patient with sympathetic ophthalmia and reported the case history.

RETINITIS COMPLICATED BY PREGNANCY

LIEUTENANT ROY R. POWELL of the United States Navy presented a patient who had a retinitis complicated by pregnancy and summarized her case history.

KERATITIS

DR. ROBERT L. NORMENT presented a patient with this condition, for observation at the meeting.

Sterling Bockoven,
Secretary.

CHICAGO OPHTHALMOLOGICAL SOCIETY

March 16, 1942

DR. SANFORD GIFFORD, *presiding*

CLINICAL MEETING

(Presented by the Department of Ophthalmology, Northwestern University)

CONGENITAL LESIONS IN THE RIGHT EYE

DR. CHARLES E. JAECKLE presented a case report of a woman who had a congenital hyaline membrane on the posterior surface of the cornea, anterior iris synechiae, associated embryotoxon, and a small cornea, right eye.

Discussion. Dr. Robert Von der Heydt said that aside from the embryotoxon and delayed absorption of the pupillary iris, the important diagnosis is an incipient bilateral essential atrophy of the iris. Evidences of this may be observed in the iris of the supposedly normal left eye at the 2-o'clock position. Pupillary action may cause traction on the pupillary-membrane remnants, more iris atrophy, and later on, a glaucoma may result.

RECURRENT RETINAL HEMORRHAGE ON A VASOSPASTIC BASIS

DR. FRANCIS W. PARKER said this patient had recurrent hemorrhages into the vitreous with retinitis proliferans and new-vessel formation. The condition was shown to be of vasospastic etiology.

Discussion. Dr. Sanford Gifford said that there was no evidence of tuberculosis in this case, but there was vascular spasm as in Buerger's disease. It was thought these changes had affected the retinal vessels. There was improvement in the vascular condition under prostigmine therapy, but the hemorrhage recurred.

VITREOUS HEMORRHAGE SECONDARY TO RETINAL PERIPHLEBITIS

DR. BEULAH CUSHMAN presented W. H., a white man, aged 48 years, whose history stated that the vision in the left eye blurred suddenly six years previously, followed by blurring of vision in the right eye several weeks later. After about six weeks the condition cleared, more rapidly in the right than in the left eye. A similar episode occurred two years later, and again in May, 1940, following which the vision in the left eye did not return. In May, 1941, the right eye was again affected. Vision at this time in the R.E. sufficed only to count fingers at 1 foot; in the L.E., light perception and faulty projection, with a divergence of 30 degrees.

Diagnosis was hemorrhage into the vitreous of the right eye, and complicated cataract, left eye. Tension was reduced in each eye. General physical examination and laboratory tests were negative for foci of infection or tuberculosis. The Mantoux test was 2+. Desensitization with tuberculin has been given regularly. General treatment included vitamin-B and -C therapy. The vision in the right eye was corrected to 20/40; the vision in the left eye remained the same.

ANTERIOR UVEITIS

DR. HOMER FIELD presented the case of A. B., a white woman, aged 31 years. The uveitis in this case was of undetermined etiology, probably due to atypical Boeck-Schauman disease. The patient had been treated for iritis for the past three years. The condition was limited to the left eye, in which the vision was light perception only. There were no external signs of involvement. Slitlamp examination revealed a plastic iritis, with a tremendous number of cells in the aqueous and a few posterior corneal deposits. The vitreous was liquefied and contained many so-called asteroid bodies. Agglutination reactions and blood serology were negative. The tuberculin reaction was very mildly positive. X-ray studies of the chest re-

vealed no pathology but X-ray examination of the bones of the extremities showed definite rarefied areas similar to those described by Jungling. A tentative diagnosis of Boeck's sarcoid with joint changes had been made.

Bilateral detachment of the retina

Dr. Dean Spear presented the case of K. D., a white girl, aged 18 years, who had been treated for pneumonia with sulfonamide therapy two years ago. She noted blurred vision at that time. In October, 1941, the vision was 10/200 in each eye, and a bilateral detachment of the retina was found.

In the fundus of the right eye a retinal cyst was seen at the 6-o'clock position; the detachment extended from the 2-o'clock to the 10-o'clock position. Clusters of pigment were seen at the periphery, and there appeared to be small holes in each area. The fundus of the left eye showed a detachment at the lower half. A retinal cyst was seen at the 6-o'clock position with disinsertion at the 4:30- to 5-o'clock position.

Electrocoagulation was performed on each detached retina with an interval of about three weeks. At that time the cyst in the right eye appeared to be flattened. There was much pigmentation in the coagulated area. A small fold extended laterally from the disc through the macular area. The retina was fixed and flat. Vision in the right eye was 20/200. In the left eye the cyst was still seen with +8.00D. lens. The retina was fixed, and there was good pigmentation in the coagulated area. Vision in the left eye was 20/65.

Discussion. Dr. Carl Schaub asked whether any further trouble was anticipated so far as the cyst was concerned.

Dr. Robert Von der Heydt said that it was not impossible that the cysts were congenital and the retinal detachment had occurred as a result of rupture of the cysts, possibly during her illness.

Dr. Dean Spear, in reply to Dr. Schaub, said he could not hazard a prognosis. The cyst was approximately 2 disc diameters in size, elevated about 12 diopters, and extended about 2 to 3 disc diameters. It was felt that the disinsertion was the result of stretching of the retina by the cyst. Whether the girl's illness had anything to do with the detachment was a question.

Dr. Robert Von der Heydt felt that in an 18-year-old girl, who had no history of trauma and whose eyes were not myopic, the cysts must be congenital in origin. He felt that the operator was to be congratulated on the result.

Bulbar vernal conjunctivitis

Dr. Helen Holt said that a boy, aged 12 years, had had dermatitis of the eczematous type since the age of 3 years, and had been under continuous treatment. One year ago redness of the eyes was noted, and later white tissue began to grow above the clear parts of the eyes. When seen in January, 1942, the visual acuity was 20/15 in each eye. Rolls of excess tissue, 3 mm. in width and about 2 mm. in height, extended along the upper limbal margins. There was no secretion, the palpebral conjunctiva was normal, and a faint blushing of the bulbar conjunctiva was present in each eye. Eosinophiles were found in numbers on smears taken from the affected area. Cutaneous and intradermal tests to discover the source of irritation had been negative. At this time, the right eye had practically cleared, but the left eye remained the same. Adrenalin and novocaine drops had been prescribed.

Convergent spasm

Dr. Helen Holt said that B. C., a woman, aged 48 years, complained of double and blurred vision. The uncor-

rected vision was R.E. 20/25, L.E. 20/50. There was markedly diminished corneal sensitivity and tubular fields typical of a functional disturbance. On reëxamination two weeks later the fields had increased slightly. Following homatropine refraction and correction, vision increased to 20/15 in each eye.

Several weeks later, the patient was referred back from the neurologic department with the suggestion that reading glasses be given for blurred near vision, and an opinion was requested as to muscle anomalies. When the patient looked at a near object a convergent spasm developed and the eyes continued to over-converge even though the target was held immobile at 13 inches. Blurring of vision occurred due to the associated spasm of accommodation. In conjugate movements to the left, the left eye did not move past the midline, although in monocular tests the action of the lateral rectus was normal.

In view of the negative past history, normal neurologic findings, and the presence of an emotional and financial problem which the patient did not wish to face, this was diagnosed as an hyterical spasm of convergence and accommodation and functional abnormality of conjugate movements to the left.

Robert Von der Heydt.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

March 19, 1942

ALFRED COWAN, M.D., *chairman*

OCULAR PHENOMENA ELICITED BY WITHDRAWAL OF AQUEOUS HUMOR IN MAN

DR. P. C. KRONFELD said it appeared that a Dutch physician by the name of Anton Nuck, Professor of Medicine at the University of Leyden, in a publication dealing with ophthalmologic matters which appeared in print in 1690, was the first author to record the fact that the aqueous humor was very rapidly regenerated following paracentesis in man. Not until about 30 years ago had it become known that withdrawal of the aqueous represents a stimulus for a number of reactive processes within the eye. Wessely, Seidel, Kahn and Loewenstein, Bonnefon, Magitot, and Hagen were the chief contributors to the subject.

The present report dealt largely with the mechanical aspects of the reactive processes set up by the withdrawal of the aqueous. The technique of the anterior-chamber puncture (hereafter designated as A.C.P.) was described in detail. In well over 1,000 A.C.P.'s which the speaker and his associates had performed during the last 14 years, injury to the lens had occurred three times. In each of these instances the technique of the A.C.P. was faulty. The speaker was not aware of any case in which an ocular infection or even a mild iritis had been set up by the A.C.P. The speaker, however, firmly believed that there were situations in ophthalmology in which withdrawal of the aqueous was contraindicated.

The amount of fluid that could be aspirated from a given eye was definitely limited and fairly constant. The term "complete" had been applied to A.C.P.'s in which the aspiration had been continued until the portion of the iris lying next to the tip of the needle began to be sucked into its lumen. At this time traces of fluid might still be present in other parts of the anterior chamber, but the speaker had never tried to collect these traces by moving the tip of the syringe to other parts of the chamber. Slitlamp examination immediately after the "complete" A.C.P. revealed either contact of the iris with the posterior surface of the cornea or the

presence of an extremely narrow space between the two surfaces. The speaker considered it unlikely that part of the fluid obtained by this technique was derived from the posterior chamber. The amounts of fluid obtained by aspiration ran closely parallel to the depth of the chamber as determined by photographic methods such as Friedenwald's and Goldman's.

The speaker and his associates had studied the rapidity of re-formation of intraocular fluid. In eyes with average chamber depth, 10 minutes after complete A.C.P., 50 percent of the original chamber contents was found to have been regenerated. Thirty minutes after the A.C.P., 75 to 80 percent of the original chamber contents might be recovered. The rapidity of fluid regeneration was slightly greater in eyes with originally deeper chambers. This difference in the rate of fluid regeneration was, however, not great enough to make up for the difference in original chamber volume. Thus the restoration of the chamber volume took longer in eyes with originally deeper chambers.

Bonnefon had proposed to distinguish four phases of the intraocular pressure after A.C.P.; namely, stade de collapsus, stade de recuperation, stade d'hypertonie, stade de retour au tonus normal. For the study of fluctuations in ocular tension after A.C.P. in man the speaker and his associates had found the following terms more convenient: (a) the initial drop, (b) the restoration time; that is, the time required for the tonometric reading to reach the original level, (c) the hypertensive phase, and (d) the hypotensive phase.

The restoration time was dependent upon the original chamber volume, eyes with deeper chambers showing a definitely longer restoration time than eyes with shallow chambers. During the restoration time there was close parallelism between the amount of fluid that had been regenerated and the intraocular pressure. Thus the restoration time was largely dependent upon and chiefly represented the re-formation of intraocular fluid or, to use Friedenwald's terminology, the transfer of fluid into the eye under conditions prevailing after A.C.P.

Of the various reactive processes set up by A.C.P., the occurrence of ocular hypertension was the most conspicuous one, and had attracted a great deal of attention. Seidel first reported it to occur in dogs and cats after partial emptying of the chamber and intrepreted it to be due to hypersecretion of aqueous, the anterior-chamber puncture representing a strong stimulus for the ciliary body. Magitot had stressed the similarity between the hypertensive reactions following A.C.P. and those following compression of the globe.

The speaker and his associates during the course of the last 14 years had studied the hypertensive phase after A.C.P. on a large number of nonglaucomatous human eyes. For the obvious reason that only a very limited number of human eyes could be subjected to A.C.P.'s, the progress of the work had been slow, but now they believe they know fairly completely the extent and the duration of the hypertensive phase in nonglaucomatous eyes. The hypertensive reactions, in glaucomatous as well as in nonglaucomatous eyes, were self-limited and subsided within four hours following the A.C.P. In a group of white and colored nonglaucomatous patients of the Illinois Eye and Ear Infirmary, the highest tension reached after A.C.P. was 42 mm. Hg. Because of the inaccuracy of all tonometric readings, even tensions as high as 45 mm. seemed possible in nonglaucomatous eyes. A tension over 45 mm. was unlikely to occur in nonglaucomatous eyes, but the existence of a

sharp borderline between the hypertensive reaction of nonglaucomatous and early glaucomatous eyes should not be expected, since there must be transitional states between nonglaucoma and glaucoma.

The speaker had no definite concept to offer with regard to the mechanism of the hypertensive reaction. Gonioscopic examination had shown that the hypertensive phase was not due to obstruction of the angle. The presence of amblyopia ex anopsia had no demonstrable effect upon the hypertensive phase. The hypertensive reaction was quantitively reproducible in the same individual if the intervals between the two A.C.P.'s were made sufficiently long. If the A.C.P.'s were repeated at intervals of two weeks or less, the hypertensive reaction tended to become less pronounced, the restoration time remaining unchanged.

The hypertensive reaction had often been explained as being due to the increased protein content of the re-formed aqueous. The speaker and his associates had not been able to recognize any parallelism between the protein content of the re-formed fluid and the severity of the hypertensive reaction.

The hypotensive phase was very slight and inconstant in nonglaucomatous eyes, but could occasionally be demonstrated with certainty in the eyes of older individuals.

In a little less than 10 percent of the A.C.P.'s done according to the standard technique, the needle track had not immediately become water-tight, but fistulation set in, lasting from a few hours to two or three days. The presence of fistulation could be recognized by slitlamp examination as spindle-shaped gaping of the needle track.

Owing to the shallowness of the chamber in eyes with narrow-angle glaucoma, the initial drop after A.C.P. was not so marked as in glaucomatous eyes, and in some cases a positive tonometric reading had been obtained immediately after the complete emptying of the chamber. The explanation of this phenomenon was that the anterior chamber in these cases represented such a small portion of the total volume of the globe that the removal of the chamber contents was not sufficient to lower the pressure from, let us say, 25 mm. Hg to below the tonometric range. If the intraocular pressure had been abnormally high before the A.C.P., the phenomenon of a residual tension after the emptying of the chamber might be very marked.

In narrow-angle glaucoma with normal ocular tensions before the A.C.P., the restoration time was found to be of approximately the same length as in nonglaucomatous eyes of the same chamber depth. The hypertensive phase in such eyes might be quite pronounced, but more often it was of the same or slightly greater intensity than in the control cases. This might also be worded by saying that a considerable number of eyes with narrow-angle glaucoma were not "provoked" by the A.C.P.

The counterpart to narrow-angle glaucoma was the so-called wide-angle glaucoma, under which term were grouped the various forms of usually compensated or noncongestive glaucoma in which the tension was elevated, although the gonioscope revealed no visible obstruction or anomaly of the angle except for the occasional presence of unusual amounts of pigment in the trabeculum. Except for this latter and rather uncommon finding, gonioscopy in these cases gave no definite clue as to the mechanism of glaucoma. The restoration time in wide-angle glaucoma tended to be shorter than in nonglaucomatous eyes of the same chamber

depth. Since the speaker's series of cases was small and since the shorter restoration time was not found in every case of wide-angle glaucoma, he was not sure enough of his finding of a shorter restoration time definitely to postulate the existence of abnormally rapid fluid transfer into the eye in this form of glaucoma. These observations, however, added weight to other findings, like the results of the administration of fluorescein by mouth, which tended to show that wide-angle glaucoma was not purely due to a disturbance of fluid outflow.

The speaker believed that a very pronounced hypertensive phase was characteristic of wide-angle glaucoma. Since, however, the distinction between wide-angle glaucoma and pseudoglaucoma—that is, an optic atrophy with complete excavation of the nerve head caused by a mechanism which was definitely not that of glaucoma—was often difficult and could not be made unless the eye in question was observed for several years, occasionally a typical glaucomatous excavation with apparently glaucomatous field might be seen in patients with normal or subnormal hypertensive reactions after A.C.P. The speaker, however, would expect that future observation of these patients would show their condition to be that of pseudoglaucoma, and not that of glaucoma.

There hardly ever was a hypotensive phase after A.C.P. in wide-angle glaucoma.

The speaker briefly discussed the response to A.C.P. of the glaucoma associated with or preceded by anterior uveitis and of the glaucoma caused by peripheral anterior synechiae due to delayed reformation of the anterior chamber after cataract operation.

Dr. Clifford Walker of Los Angeles, whose opinion the speaker respected very much, in a discussion of the value of the A.C.P. for the early diagnosis of glaucoma before the Los Angeles Society of Ophthalmology and Otolaryngology, expressed the opinion that the risk of the procedure was too great for the value of the information to be obtained. The speaker agreed with him that the practical diagnostic value of the information obtained by the A.C.P. was not very great, especially if the patient in question could be watched closely. To the speaker, however, the study of the reactive processes after A.C.P. had been an eye-opener with regard to the mechanism of many phenomena that they observed daily in clinical ophthalmology. The speaker would be inclined to modify Dr. Walker's statement to read that the risk entailed in properly executed A.C.P.'s was very small compared to the theoretical value of the information that had been obtained.

Warren S. Reese,
Secretary.

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NATIONAL RESEARCH COUNCIL SUBCOMMITTEE ON OPHTHALMOLOGY

Two years ago the National Research Council, which was organized during the First World War, formed a series of committees to serve as advisory to the War and Navy Departments. Ophthalmology was considered a subdivision of surgery and a Subcommittee was formed. The activities of this Committee during the past biennium may be of interest to Journal readers.

These activities fall into three fairly distinct groups: first, advisory in regard to specific problems involving our armed forces assigned to the Committee for study and recommendations; second, the consideration of research projects; third, the preparation of a war manual.

Meetings have been held at irregular intervals, usually in Washington, although one was in Chicago and one by intercity telephone hook-up. It has been found that much greater satisfaction results from direct discussion with representatives of the Army, Navy, Veterans Administration, and other organizations. Meetings are held in the National Research Council building on Constitution Avenue. They convene at 10 o'clock and are generally completed by late afternoon. Most members arrive on an early morn-

ing train and depart on an evening train. Accommodations being what they are—or, more accurately, are not—in Washington, one is not tempted to linger.

It would not be expedient nor feasible to discuss here all of the problems considered, but one or two examples might be of interest as illustrations. A rather involved one has been that of rehabilitation of the war-blinded. A major difficulty was the lack of knowledge of how many of these there would probably be. No one knows how long the war will last, how much combat our troops will see, whether the percentage blinded to total casualties will be the same as in previous wars or because of a different type of warfare be quite at variance with it. Having made as good an estimate as possible, the question then was: Shall they be cared for in separate Army and Navy hospitals, or in a joint hospital, or in a Veterans hospital? Should WACS and WAVES be cared for; or civilians injured in bombings? It was thought that it might be wise to leave the care of the war-blinded to the Veterans Administration, as these would logically be discharged from the armed forces on completion of any necessary surgery or medical care and thereafter be veterans, and this organization is the one officially designated for this. The Veterans Administration, however, has no special institution for handling these patients where they could be placed under the care of workers trained in the rehabilitation of the blind. Such a center, as advised by the Subcommittee on Ophthalmology, should be near or in a large city where things of interest to the blind are located, for it must be remembered that there is no power to hold these men more than a very limited time after their discharge from the service. So, it is necessary to make the institution as attractive as possible, or the recently blinded individual will depart as soon as his pension begins to reach him and not wait for the instruction and training that the Government would give him to qualify him for some specific work in which he may be interested and for which he is suited. It is well enough for these men to return to their homes, but they should not do so until they have been helped as much as possible to meet their new situation mentally and physically.

Another matter of concern in the past year has been the occurrence of epidemic keratoconjunctivitis. Much thought was given to the best methods for controlling this. Reports and discussions of this subject have already appeared in this Journal.

Various unorthodox exercises that have been alleged by some nonmedical practitioners to increase visual acuity and by some even to aid in color discrimination are being investigated.

Recommendations as to the ophthalmic preparations to be included in the surgical kits are being made. Questions about tonometers, the use of contact glasses, eye shields, and such matters have been on the agenda of this Committee.

From time to time the opinion of the Committee is asked concerning the advisability of certain researches being conducted for the armed forces in medical schools and hospitals and, if the study is deemed worthwhile, what amount of money should be allocated for the problem. A considerable number of such projects have been endorsed and are being carried on. Good judgment is needed to select those that will bear fruit within the necessary time. There have not been as many war ophthalmologic problems submitted as was anticipated, though good work is being done on a few.

Of the "Manual of ophthalmology" there is no need to write, since most of our readers have undoubtedly seen it. Intended for the general practitioner who may be required to work outside of his

field, these special handbooks are undoubtedly valuable if a set is available when needed. One objection is the rapidity with which they become outmoded. One chapter on which considerable time was spent in compilation was that on visual standards. Unfortunately, when the time came for actual publication, the standards had been so changed and apparently were still in such a state of flux that the chapter had to be deleted.

The present make-up of the Committee is as follows: Drs. Harry Gradle, Chairman; William Benedict; Frederick Cordes; Sanford Gifford; Everett Goar; Lawrence Post; Alan Woods; and Captain Charles Best, Canadian Consultant represented by Dr. Alexander MacDonald.

Lawrence T. Post.

REFRACTION DEPARTMENT

There has been so much interest evinced by our readers in the notes from the Refraction Clinic of Dr. Albert E. Sloane, that it has been decided to conduct a department of interesting refraction cases.

Since the greater part of every ophthalmologist's practice is refraction, it would seem that such a department would be of great value to our readers. We therefore solicit contributions of interesting cases. These should be sent to the editor-in-chief, at 640 South Kingshighway, Saint Louis, who will confer with Dr. Sloane concerning their suitability for publication. If, during the next year, this activity justifies it, a special section will be assigned to it.

Lawrence T. Post.

MORE ABOUT EYE EXERCISES

Pascal's proposal (American Journal of Ophthalmology, 1943, volume 26, June, page 636) that the "Bates system" should be made the subject of research by a university eye clinic is not very likely to meet with general approval, and will perhaps be scorned by many ophthalmologists. Pascal, we note, recommends that Huxley's book on the "Art of seeing" "be taken more seriously by ophthalmologists than it apparently is"; because, although "a great deal of the 'science' in Mr. Huxley's book is pseudoscience," yet there may be "some points in the Bates system which are sound and which can be used with advantage, . . . as an adjuvant to the correction of refractive errors."

A personal letter from another colleague suggests that to call the method under discussion "unscientific and absurd, which to be sure it is, is perhaps too negative an approach," and that "a more positive approach would be to recognize what modicum of truth there may be in the claims"; further that it would be "sounder to assume that there is nothing the Bates school knows which we ophthalmologists do not know and apply when the situation requires it."

The same correspondent reaches the general conclusion that "there is nothing to investigate in the Bates method, but we can afford to be less harsh and more benevolent in our reaction to it, and treat the clients of it with more sympathy and understanding of their problems."

It has been hinted that the subject will be discussed before at least one of our national societies and also before an important local organization. It may therefore be well to consider on the one hand what circumstances have favored the Bates movement and have promoted its popularity among certain members of the community; and on the other hand what "modicum of truth there may be in the claims" made by Bates and his successors.

The attempt to escape the use of spectacle lenses, in cases where ophthalmolo-

gists are disposed to recommend them, is sometimes merely an aesthetic or psychologic manifestation. The individual, regardless of other considerations, is willing to do almost anything to avoid what he regards as the disfigurement and the annoyance of having to wear these "crutches," as Aldous Huxley likes to call them. This group of individuals does not need to concern us greatly. "He that complies against his will is of his own opinion still."

Huxley himself belongs to another group, small but relatively important—those who, as the result of serious ocular disease (such as Huxley's adolescent keratitis punctata) can never hope to obtain perfect vision, even by the aid of correcting lenses. Some of these sufferers wander, as Huxley seems to have wandered, from one eye expert to another, vainly hoping for good sight, and at times, no doubt, losing rather than gaining by the effort of the ophthalmologist to find satisfactory correcting lenses.

A third group, intermediate in numbers and significance, yet sufficiently important during the war emergency, consists of those candidates for special classification in the Army, the Navy, the Marines, or the air services who are disqualified on account of refractive or muscle errors, and who insist on finding some means, other than spectacle lenses, which will enable them to qualify.

Numerically very much the most important class is that of the patients who need correcting lenses but have never succeeded in finding the proper refractive measurement, the proper muscular adjustment, or the correction for an unrecognized aniseikonia, or the necessary combination of all three.

For driving this last group into the hands of the Bates school the responsibility lies with ophthalmologists and optometrists—more frequently no doubt with the latter than with the former, yet all too frequently with the ophthalmologist.

How often we see patients who have apparently struggled year after year, from one optometrist to another and then to an ophthalmologist, or from ophthalmologist to ophthalmologist, or occasionally from ophthalmologist to optometrist, wearing prescription after prescription with which they were never comfortable, and who yet were in the last analysis capable of proper correction. In desperation, and grasping at the proverbial last straw, some of these patients pass into the hands of the Bates practitioner, honest or dishonest.

Every overcorrected myope, every myope whose two eyes are not properly balanced, or who has an inaccurately measured astigmatic error, is a potential candidate for the Bates system. The same is true of many uncorrected hyperopes, especially if subjected to the annoyance of poor balance or astigmatic imperfections; and it is of course equally true of the patient in whom astigmatism is the chief source of trouble but who has never received the right strength and axis of cylinder for each eye.

The existence of the Bates school may be blamed in large part on chaos and neglect in the teaching and practice of refraction; and the most important remedy for the activities of the Bates school is to be had from systematic improvement in refractive technique. Nor should it be forgotten that an important part of refractive technique lies in the proper adjustment of frame and lenses, and that a good refractive diagnosis may be spoiled, so far as the result to the patient is concerned, by neglect as to centering and angling of the lenses or as to their distance from the eyes.

If the patient, through imperfect work, has failed to obtain comfort with his

glasses, he may the more easily be persuaded that glasses are harmful and that he can be made more comfortable without them.

The candidate for war service, having a very practical reason for demonstrating ability to satisfy certain visual standards without glasses, is often a particularly easy victim of the most unscrupulous type of Bates practitioner. It is difficult to accumulate a body of substantial evidence as to what is going on with regard to these charlatans, but from time to time one hears of cases in which the applicant, after the use of "exercises," has gained a line or two on the Snellen chart and so has been able to pass an examination for the Navy or the flying forces.

It must be remembered that varying efficiency of illumination in different recruiting offices could play an important part as to conflicting results in successive examinations of the same candidate. But it is probable that even more important is the instruction of the applicant, by his Bates practitioner, in certain special maneuvers with which the applicant may learn to struggle a line or two further down the chart. Such tricks are not altogether honest, but the applicant does not necessarily realize the harm that might result from what is virtually a misrepresentation.

It was to be expected, and has actually occurred, that the improved vision thus shown would break down under pressure of active service. Visual standards in the armed forces are based upon considerations of safety and efficiency. The aviator who has a disturbing amount of hyperopia, or an important astigmatic error, or even a low myopia, may be able to improve his visual record under favorable physical conditions, or by certain efforts with the orbicularis and elevator muscles of the lids. But, in the presence of fatigue or difficult flying conditions, his basic visual defect may render him a source of danger not only to himself but to his comrades, to say nothing of the risk to valuable fighting machinery. Hence, what appeared to be gain is really loss, and what appeared a triumph for the Bates method may come dangerously near being rank treachery. Yet we are told that various Bates practitioners (chiefly among the less creditable group of optometrists) are regularly selling such "services" for substantial monetary considerations. It is as to this kind of trickery, in relation to the war emergency, that the most valuable results are likely to be obtained from well-organized research into the achievements of the Bates method.

The "modicum of truth" concerning the "Bates system" will inevitably be found to include this sort of trickery. Such further results as it obtains depend, not upon any elements of truth in the physical claims of the school, but upon a combination of autosuggestion with certain universally recognized but less generally practiced principles of rest and relaxation.

In spite of the fanciful language in which they are often clothed, the so-called Bates exercises act chiefly to rest the eyes and to induce conditions of mental relaxation. The importance of the relationship between relaxation and activity is perhaps too frequently overlooked by physicians, including some ophthalmologists. Yet in writing on this theme, as well as in various other details, Huxley is guilty of several rather reckless misstatements. He says, for example: "Adequate cognition of the external world depends upon movement. . . . And yet for some inexplicable reason, orthodox ophthalmologists have never paid the smallest attention to it. The first person

to devote any serious thought to this manifestly important problem was Dr. W. H. Bates."

He says elsewhere: "Orthodox ophthalmologists are content to palliate the symptoms of poor sight by means of those valuable crutches, artificial lenses. They work only on the sensing eye and ignore completely the selecting, perceiving, and seeing mind."

Many ophthalmologists expend a good deal of energy in warning patients to avoid excessive continuity of effort and to aim at bodily and mental relaxation, even during the performance of work. Much of Huxley's book is devoted to this very topic, and some of the most laughable forms of eye exercises recommended by Huxley and his teachers are simply systematic means of attaining relaxation. Good examples of this are to be found in Huxley's chapters on "palming," on "blinking," on "breathing," and on "swinging"; as well as in the general chapter on "relaxation."

Perhaps no better example of this pursuit of mental relaxation could be had than Huxley's description of "nose writing." (See quotation on this subject in the previous editorial, American Journal of Ophthalmology, February, page 200.) Readers will remember Huxley's dictum that "A little nose-writing, followed by a few minutes of palming, will do wonders in relieving the fatigue of a strained mind and staring eyes, and will result in a perceptible temporary improvement of defective vision. This temporary improvement will become permanent, as the normal and natural functioning fostered by nose-writing and the other procedures described in this book becomes habitual and automatic."

Huxley insists repeatedly on the fact, which might at first appear a trifle paradoxical, that relaxation is often best attained actively, under concentration, rather than passively and during a period in which the subject seeks to banish all definite thought from his mind. We are told to "work hard but never under tension," to "avoid being bored or boring others."

Not many of us would quarrel with the statement that "inhibition of the movement of the eyes . . . is brought about by too great a desire to see." The fatigue and strain that come from stagnancy in effort of any part of the body are familiar to us all.

Bates at first taught his clients to imagine black while palming (cupping the hand over the eye). But he later advised "remembering pleasant scenes and incidents out of (the patient's) own personal history." Huxley naïvely comments on the "refreshment in the temporary exclusion of light, and comfort in the warmth of the hands." He also advises that "where circumstances make it difficult or embarrassing to assume an attitude of palming, it is possible to obtain a certain measure of relaxation by palming mentally—that is, by closing the eyes, imagining that they are covered with the hands and remembering some pleasant scene or episode." Many of our own very loyal patients, hard pressed at business or at recreational reading, have probably complied with Huxley's recommendation of "gentle rubbing of the temples . . . often . . . soothing and refreshing"; or would even agree that "eye fatigue may also be relieved by rubbing and kneading the muscles of the upper part of the nape of the neck."

It is not necessary to condemn any of a group of innocent pastimes recommended by Huxley and others. More or less, they are a part of common human experience. Thus Huxley advises juggling two bowls from hand to hand, or

combining rapid fixation with the exercise of memory in the form of simple games with dice or dominoes.

But we are bound to disagree with Huxley and his predecessors, and sometimes to laugh at them, when, in treating of astigmatism, they indulge in such claims as that "spectacles tend to fix the cornea in that particular condition of distortion present at the moment of the oculist's examination. . . . But if the astigmatic person will discard his artificial lenses, learn the art of passive and dynamic relaxation, . . . he can do much to diminish, or even altogether eliminate his disability."

Duke-Elder well says (British Medical Journal, 1943, May 22, page 635): "Whatever be the value of the exercises, it is quite unintelligent of Huxley to have confused their advocacy with so many misstatements regarding known scientific facts. . . . The most stupid feature about his book, however, is that he insists throughout on the physiological mechanism whereby these exercises are supposed to work. It would at least have been logical if he had continued to allow the reader to assume that he was speaking in ignorance of anything except results. . . . For the simple neurote who has abundance of time to play with, Huxley's antics of palming, shifting, flashing, and the rest are probably as good treatment as any other system of Yogi or Coué-ism. To these the book may be of value. It is hardly possible that it will impress anyone endowed with common sense and a critical faculty. It may be dangerous in the hands of the impressionable who happen to suffer from glaucoma or detachment of the retina, and undoubtedly will be dangerous in the hands of the anxious parent of a myopic child. . . . But the greatest value of the book will be to the psychiatrist as an intimate and revealing self-study in psychology."

W. H. Crisp.

BOOK NOTICES

THE PRACTICE OF REFRACTION. By Sir Stewart Duke-Elder. Fourth edition, clothbound, 328 pages, 183 illustrations. Philadelphia, The Blakiston Company, 1943. Price $4.50.

This fourth edition of Duke-Elder's valuable book on "The practice of refraction" is very little changed from the third edition published in 1938. This textbook has been one of the most popular on the subject of refraction since its first publication in 1928. The presentation is simple and sufficiently complete to satisfy any but those who desire a deep or a profound mathematical discussion of the problems involved. For the use of the average student of refraction it leaves nothing to be desired.

Lawrence T. Post.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

9

CRYSTALLINE LENS

Samuels, Bernard. **Cataract complicating corneal scars after perforating ulcers.** Arch. of Ophth., 1943, v. 29, April, pp. 583-599; also Trans. Amer. Ophth. Soc., 1942, v. 40, p. 292.

The lenses of 36 globes with healed perforating ulcers of the cornea were studied. Most of the eyes were removed because of staphyloma, secondary glaucoma, or atrophy of the globe. In most instances the corneal scar was the result of serpiginous ulcer, but ulcers from scarlet fever, smallpox, ophthalmia neonatorum, and measles were encountered.

Ten of the lenses were transformed into membranous cataracts. The capsule was found to be intact in 23 cases. There had been an intralenticular invasion of mesodermal tissue in some of the lenses showing large capsular defects. Three morgagnian cataracts were found in which, because of fluidity of the cortex, the relatively solid nucleus had changed its position. Calcification was observed in only four lenses, in spite of the long duration of the cataracts. An atrophic eye showed vascularization, chalk, and bone within the lens capsule. Before such a change can occur there must be a break in the capsule with mesodermal invasion. A small calcified lens was observed in the act of perforating the globe. In this case a sharp calcified splinter was projecting into the corneal scar. Soemmering's crystalline ring was encountered in a number of cases.

Twenty-three of the eyes were glaucomatous. Usually in these eyes the lens is swollen and the capsule distended and without folds. Folding and separation of the anterior lens capsule from the lens substance were frequently noted. Proliferation of the subcapsular epithelium is probably initiated by toxins absorbed from the ulcer but may also result from trauma at the time of the corneal perforation. Two small groups of lens epithelial cells were found outside of the lens capsule, as though they were attempting to form a new lens. Only four eyes were found with "dead lenses," containing no living epithelial cells. (References, 14 illustrations.)

John C. Long.

10

RETINA AND VITREOUS

Bangerter, A. **Experience with the "hole finder" in the operation of retinal detachment.** Ophthalmologica, 1942, v. 104, Oct., p. 213.

The "hole finder" is an instrument described by Goldmann in 1936. It consists essentially of a metallic capsule with three small hooks by means of which it can be attached to the sclera as nearly over the retinal hole as possible. An electric lamp is then inserted into the capsule and the retina inspected by indirect ophthalmoscopy. When the site of the retinal hole is in view the ophthalmoscopic lamp is switched off, that of the hole finder is turned on, and if the capsule was properly placed a spot of light appears in the hole. If not it is easily moved and usually on second try is accurately placed. Its position is then marked on the sclera and the hole closed by diathermy. In this report the author confirms the usefulness of the invention by describing the results of 65 operations. F. Herbert Haessler.

Hill, E. G. **A note on some symptoms associated with a retinal lesion.** Brit. Jour. Ophth., 1943, v. 27, March, pp. 97-104.

The subjective symptoms, associated with a thickening of the internal limiting membrane in the macular region, were (1) image distortion with localized aniseikonia, (2) the appearance of a shadowy luminous veil, (3) an "afterflash" phenomenon, and (4) disturbance in the brightness of the field with rapid movement of the eyeball or on any attempt to converge the eye nearer than the normal range of accommodation.

There was no material diminution of visual acuity and no progressive deterioration. Strong sources of radiation may have been the predisposing cause of the retinal lesion. (2 illustrations.) Edna M. Reynolds.

Klien, B. A. **Anticoagulant therapy of occlusion of central vein of retina in relation to pathogenesis and differential diagnosis.** Arch. of Ophth., 1943, v. 29, May, pp. 699-710.

In view of the recent reports of the use of heparin in cases of retinal venous occlusion the author outlines four mechanisms by which this condition is produced and discusses the relative value of heparin therapy.

The most frequent type is due to systemic angiosclerosis in older persons. In the course of an essentially chronic sclerotic atrophic process, which affects the central vessels, the central connective strand, and the lamina cribrosa, the lumen of the vein is gradually narrowed by compression from outside the vessel. Whenever the compression of the vein has reached a stage of complete closure of the lumen at one or more places, an irritative proliferation of the endothelium sets in, which accelerates the venous occlusion. Occlusion of the central vein in generalized carcinomatosis may be explained by a similar mechanism. In these conditions anticoagulant therapy is of little or no value, as thrombus formation is only the terminal event bringing about complete occlusion of an already narrowed venous aperture.

The second type of occlusion is by thrombus formation in blood dyscrasias such as polycythemia and thrombocythemia. This may be aggravated by a coexisting vascular disease in which we have the predisposing factors of increased blood volume, high viscosity, and slowing of the blood flow. In these

cases heparin or dicoumarin therapy is of definite value, especially in the early stages before secondary changes have supervened. The rapid action of these preparations may be prolonged and supported later, if necessary, by roentgen irradiation of the bone marrow.

The third type of occlusion is by stagnation thrombosis following widespread arterial spasm. The first requisite for stagnation thrombosis is the production of a sudden decrease of the arterial retinal blood supply by such widespread spasm. This sudden diminution of the retinal arterial blood volume may reduce the pressure within the central vein to a point so much lower than the intraocular pressure that the vein collapses at the point where its pressure is lowest. Heparin or dicoumarin therapy should be of definite value for this type of occlusion, with the support of vasodilators. In this third type may be included the following etiologic situations: (a) early hypertension with marked spastic episodes, (b) a general surgical procedure or cranial fracture, and (c) congenital heart disease with compensatory polycythemia.

The fourth type of retinal venous occlusion is that caused by inflammatory disease of the venous wall, which leads to complete occlusion of the venous lumen by secondary thrombus formation. The most frequent example is tuberculous retinal periphlebitis. Here the employment of anticoagulants is contraindicated.

A study of such cases therefore includes a search for angioneurotic tendencies, such as migraine, and examination of the vascular system and the blood. The author gives a case report illustrating each type. (3 figures, references.) Ralph W. Danielson.

Lloyd, R. I. **The hereditary macular degenerations.** Amer. Jour. Ophth., 1943, v. 26, May, pp. 499-508. (15 illustrations, bibliography.)

Rycroft, B. W. **Night vision in the army.** Brit. Med. Jour., 1942, Nov. 14, p. 576. (See Section 1, General methods of diagnosis.)

Tiscornia, B. J. **Concepts regarding hypertension and the ocular fundus.** La Semana Med., 1943, v. 50, April 1, pp. 688-693.

This paper, read before a group of medical internists, discusses in some detail the vascular anatomy and ophthalmoscopy of the subject.

Wolff, Eugene. **The vitreous route for retinal toxins.** Glasgow Med. Jour., 1942, v. 138, Nov., p. 157.

Although the author lacks definite proof, he ventures to suggest that toxins may act upon the retina not only through the blood circulation, but by diffusion through the vitreous. In panophthalmitis the eye remains quiet until the toxin reaches the vitreous, then an intense leucocytosis sets in in the pars plana of the ciliary body, the retina, and the nerve head. In the severest form the leucocytes form an abscess in the vitreous. In less severe cases the toxins produce cuffs around the retinal vessels, leucocytes wander out, and serum transudes. In the milder form edema of the macula is produced.

In siderosis, the iron after having been converted into a soluble, diffusible compound makes its way into the vitreous and from here it spreads to the structure with which the vitreous is in close contact. This explains why the ganglion-cell layer of the retina is first affected. The pigment found in the retina in iridocyclitis is, according to

the author's opinion, derived from the ciliary body. It enters the vitreous and thence passes into the retina.

In tabes, the luetic toxin enters the vitreous at the site of origin of the vitreous, and affects, therefore, first the peripheral part of the retina and the bulbar part of the optic nerve. Furthermore, the toxin spreads anteriorly to the iris, altering its texture and color by its irritation and causing contraction of the iris sphincter. Methyl alcohol enters the vitreous to become oxidized into formalin and formic acid. These derivative products are slow to disappear and have a long time to act upon the retina.

Because the vitreous is a strong oxidizing agent, a hemorrhage into it retains for a long time its bright red color. R. Grunfeld.

Wyburn-Mason, Roger. **On some anomalous forms of amaurotic idiocy and their bearing on the relationship of the various types.** Brit. Jour. Ophth. 1943, v. 27, April, p. 145, and May, p. 193.

Twenty-seven cases of amaurotic idiocy are reported, ranging in age from 10 months to 25 years. The author believes that two distinct types of the disease exist and that they are not related except in their similar histologic appearances.

The infantile type of amaurotic idiocy is regarded as mainly confined to Jews, has its onset before the third year, and is rapidly fatal. It is related to Niemann-Pick's disease, lipoid changes being found in the liver and spleen and increased blood lipoids being present in some cases. Infantile amaurotic idiocy is regarded as a monosymptomatic form of a general lipoid dystrophy of which Niemann-Pick's disease is the full syndrome.

The juvenile type of amaurotic idiocy begins usually at the age of from six to eight years, but sometimes as early as the second year or as late as the twenties. It occurs, according to the author, chiefly in non-Jews, has a slower course, and occasionally shows only an optic atrophy instead of macular changes, the final picture resembling retinitis pigmentosa. Often only cerebral or retinal changes are present in older cases. There is no record of the association of Niemann-Pick's disease with the juvenile type of amaurotic idiocy either directly or in a family.

Macular heredodegeneration is probably unrelated to the juvenile form of amaurotic idiocy, because no families have been reported upon in which both diseases occurred together. Macular heredodegeneration appears to be inherited in a dominant manner, while amaurotic idiocy has been shown to be inherited as a recessive character.

Edna M. Reynolds.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

McDermott, W., Webster, B., Baker, R., Lockhart, J., and Tompsett, R. **Nutritional degeneration of the optic nerve in rats; its relation to tryparsamide amblyopia.** Jour. Pharmacology and Exper. Therapeutics, 1943, v. 77, Jan., p. 24.

The mechanism of the production of amblyopia which may occur in humans following the use of tryparsamide has always been obscure. It may occur suddenly with relatively small doses of the drug, and about 75 percent of the reactions occur within the first ten injections. These facts have not been satisfactorily explained by the concept of individual sensitivity. Exactly how

syphilis produces optic-nerve atrophy is not known. Tryparsamide amblyopia can occur in the absence of syphilis, as shown by Pearce in African natives infected with trypanosomiasis. There is increasing demand for the drug in the latter disease.

After producing in rats deficiencies of vitamin A and of several components of the vitamin-B complex, observations were made of the effect of tryparsamide on some of the groups of these animals. Degeneration of the optic nerve occurred in rats kept on synthetic diets from which the vitamin-B complex was omitted. Tryparsamide given concurrently aggravated the atrophy. Other observations lead the authors to believe that nerve degeneration in completely B-deficient rats may be caused by absence of one or more of the known crystalline members of the group, not pantothenic acid alone.

Rats kept on synthetic diets completely free from vitamin A developed marked degeneration of the optic nerve; those receiving low vitamin-A supplements showed less degeneration. No degeneration was present in the animals kept on synthetic diets supplemented by adequate amounts of yeast and cod-liver oil, whether they received tryparsamide or not.

F. M. Crage.

Verma, O. P. **Partial degeneration of the optic nerve associated with vitamin deficiency.** Indian Med. Gazette, 1942, v. 77, Nov., p. 646.

The condition, evidenced mainly by slow progressive loss of vision and temporal pallor, is not uncommon in young adults. The author reports his observations on 48 patients (20 of them females) ranging in age from 15 to 30 years. Nearly one half showed angular stomatitis and fissured tongue as seen in riboflavin deficiency. Superficial spots on the corneas were observed by slitlamp in 38 cases. Tobacco, alcohol, and infection were all ruled out, as well as neurologic etiology.

The condition is considered due to dietetic deficiency. Yeast and shark-liver oil helped the earlier, milder cases.

F. M. Crage.

12

VISUAL TRACTS AND CENTERS

Boyd, E. M., Lee, B. K., and Stevens, M. E. T. **Effect of optical stimuli on output of urine in albino rats.** Endocrinology, 1943, v. 32, Jan., p. 27.

Repeated optical stimuli in the form of short flashes of bright light at brief intervals caused diuresis over a period of three hours in albino rats. This reaction failed to occur if the eyes were removed from the rats. Injection of an extract from a whole pituitary gland of one rat into another rat caused diuresis. The diuretic effect was enhanced if the rat from which the pituitary extract had been obtained was previously exposed to flashes of light from two to three hours. Neither optical stimuli nor injection of pituitary extract had any effect upon the output of urine if the animals were previously made diuretic by giving them distilled water through a stomach tube, or by exposure to cold.

The authors believe that stimuli of the eyes set up an impulse over an optico-hypothalamo-hypophysial pathway, thus liberating water-balance factors from the neurohypophysis.

R. Grunfeld.

Burch, F. E. **Ocular evidence of head trauma.** Wisconsin Med. Jour., 1942, v. 41, Dec., p. 1092.

Ocular symptoms indicating brain trauma are the following: ecchymosis and hemorrhage into the lids, conjunctiva or orbit; paralysis of extraocular muscles including ptosis; nystagmus; pupillary and field changes; fundus and optic-nerve changes. The earlier the eye symptoms appear the graver the prognosis. Anisocoria with absence of pupillary reaction signifies cranial hemorrhage. Widely dilated pupils indicate a more serious trauma than fixed miotic pupils. The sixth nerve is most commonly involved. Involvement of the seventh and eighth nerves arouses suspicion of temporal-bone fracture. Paralysis of intrinsic branches of the third nerve implies a serious nuclear or central lesion. Total ophthalmoplegia suggests fracture of or pressure within the orbital fissure. Late involvement of the cranial nerves suggests callus formation, inflammatory exudate, meningitis, aneurism, or arachnoiditis. Hemorrhage into the optic-nerve sheath is frequent. Papilledema occurs four to six days after a trauma. Injury to the anterior cranial fossa does not produce papilledema, but injury to the posterior fossa with closure of the iter produces a high degree of papilledema. Optic atrophy may become evident from one week to three months after injury. In rare instances both nerves are involved, pointing to a fracture of both foramina or the sella turcica, or to extensive basal hemorrhage, providing syphilis has been ruled out. The differential diagnostic point between orbital and arteriovenous aneurism following head trauma is a pulsating swelling above the inner canthus, which is pathognomonic of arteriovenous aneurism and is not present with orbital aneurism.

R. Grunfeld.

Dynes, J. B. **Permanent visual-field changes in migraine.** The Lahey Clinic Bull., 1943, v. 3, Jan., p. 92. (See Section 3, Physiologic optics, refraction, and color vision.)

Francis, W. S. **An unusual case of compressed-air illness**. United States Naval Med. Bull., 1943, v. 41, Jan., p. 188.

Compressed-air illness is the term now generally adopted for the malady formerly known as caisson disease, bends, or diver's palsy. A healthy young man was lowered to a depth of 275 feet of water in five minutes, and remained at that depth four minutes, at the end of which time ascent by stage decompression was started in accordance with standard decompression tables. About three minutes after emergence from the chamber the man was amazed to find on picking up a newspaper that he could see the print clearly but that the words had absolutely no meaning to him. He was then put back into the pressure chamber at 75 pounds pressure and his symptoms disappeared. He was next gradually decompressed, and on reaching the surface he was still normal and suffered no residual disturbance. The alexia is explained as having been caused by a gas bubble at the angular gyrus of the brain. The case illustrates treatment by recompression.

J. Wesley McKinney.

Hughes, R. H., and Couper, E. C. R. **Oligodendroglioma in an infant of eight months**. Archives Dis. in Childhood, 1942, v. 17, Sept., p. 147.

A midline supratentorial tumor with an oligodendrogliomatous center and a medulloblastomatous periphery occurred in an infant of eight months. Of

this rare combination of clinical and pathologic findings, the first symptoms were strabismus and ptosis of the left eye. Gertrude S. Hausmann.

Nathan, P. W., and Turner, J. W. A. **The efferent pathway for pupillary contraction.** Brain, 1942, v. 65, Dec., pp. 343-351.

In this paper evidence is presented to show that there must be two separate pathways for efferent pupilloconstrictor fibers. It is generally agreed that these fibers leave the third nerve nucleus, run with the nerve to the inferior oblique muscle, enter the ciliary ganglion, and are distributed to the globe by way of the short ciliary nerves. If this is the only pathway by which constrictor fibers reach the sphincter, it follows that complete interruption of this pathway will result in a pupil that reacts to neither light nor convergence. Several cases are presented from the literature, with records of recent war wounds which seemed to show peripheral damage to the third nerve. All the cases presented either dilated or constricted pupils in one eye which failed to react to light or darkness directly or consensually, but reacted normally to accommodation and convergence. No certain second pathway from third nerve to iris sphincter has been demonstrated, but the evidence from these cases points to its existence.

J. Wesley McKinney.

Scheffler, M. M. **Visual loss following distant hemorrhage.** Arch. of Ophth., 1943, v. 29, March, pp. 449-456.

Visual disturbances following hemorrhage from any source are of two varieties. The first is purely functional, generally following closely after a hemorrhage, and probably due to anemia of the brain or retina, although no fundus changes are seen and the disturbance is usually transient. The second type comes on later, is more serious, but fortunately quite infrequent. The visual loss usually occurs in a patient having some physical disease and is more frequent when there are recurrent hemorrhages than when there is a single large hemorrhage. Visual loss only rarely occurs in a person in good health, no matter how profuse the hemorrhage.

Causation has been variously attributed to anoxemia of the tissues, toxins, anemia, or edema. When the patient is given transfusions the anemia is relieved, and as the edema disappears restoration of vision occurs. The addition of the toxic factor keeps the condition from remaining reversible, and a degenerative process develops in the ganglion cells.

Clinically the patient first complains of blurred vision three to eight days after the hemorrhage. The longest interval has been 18 to twenty days. All forms of field change are reported, a lower-field defect being the most common. When improvement occurs, its appearance varies with the time of the hemorrhage. When the visual disturbance occurs with the hemorrhage, improvement results in 22 percent of the cases; within 12 hours, in 71 percent; in 12 hours to ten days, in 41 percent; after ten days, in 50 percent. The amount of improvement is often discouraging. The treatment is to combat the bleeding and to give transfusions.

A case is reported of a 43-year-old man who had a hematemesis of 12 hours duration resulting from a peptic ulcer. The red blood count was reduced to 1,700,000 and the hemoglobin con-

tent to 31 percent. In spite of immediate repeated transfusions to combat retinal ischemia, the patient developed retinal hemorrhages and edema of the discs on the tenth day. One month after onset of the bleeding the vision was 20/13 in one eye and 2/200 in the other. There was restriction of the visual fields. (Fields, references.)

Ralph W. Danielson.

13

EYEBALL AND ORBIT

Porter, C. T. **Orbital infections.** Annals of Otology, Rhin., and Laryng., 1942, v. 51, Sept., p. 780.

Orbital infection may be caused by furuncle or carbuncle, injury to the face, infection from teeth, or sinus infection. In the last the infection may be carried into the orbit by venous thrombosis, thrombophlebitis, or direct extension. Differential diagnosis from other conditions, such as osteomyelitis, cavernous-sinus thrombosis, and hemorrhage into the orbit, is discussed.

With orbital infection the patient should be hospitalized and X-rayed, cultures should be made, and sulfadiazine treatment should be immediately instituted. The blood level should be kept at 10 to 20 mg. per 100 c.c. If the culture shows beta-hemolytic streptococcus, sulfanilamide is to be substituted. If after 48 hours there is no evidence of improvement surgical intervention is necessary. If marked edema of the lid, exophthalmos, and limitation of motion are present, and there is danger to vision, operative measures are indicated as soon as a proper blood level of sulfadiazine has been obtained. If the orbital infection was caused by sinus infection, radical exenteration of the ethmoidal sinus and removal of the floor of the frontal sinus are indicated. R. Grunfeld.

Woods, A. D. **Pulsating exophthalmos.** Jour. Iowa State Med. Soc., 1943, v. 33, Feb., p. 49.

The following are the principal causes of pulsating exophthalmos: rupture of the carotid artery into the cavernous sinus, aneurysm of the internal carotid artery in the cavernous sinus, aneurysm of the ophthalmic artery within and without the orbit, and tumors within and without the orbit. Carotid-cavernous arteriovenous aneurysm is by far the commonest variety, caused in the great majority of cases by trauma. Disease of the vascular system predisposes.

The pathogenesis of pulsating exophthalmos is dependent on increased pressure within the cavernous sinus with consequent stasis in the ophthalmic vein. This venous stasis is seen as dilated conjunctival veins with redness and edema of the conjunctiva and eyelids, proptosis, extraocular muscle paralysis, and distended retinal veins with edema of the disc and hemorrhages. The outstanding feature is the pulsation and bruit. The pulsation may be felt in and about the eye. The bruit may be heard about the eye, forehead, or temple. The treatment is usually carotid ligation, complete or partial, immediate or gradual, depending on the age of the patient and the state of the blood vessels.

The author reports spontaneous cure in the case of an 87-year-old woman whose pulsating exophthalmos resulted from a fall. J. Wesley McKinney.

14

EYELIDS AND LACRIMAL APPARATUS

Guy, L. P. **Surgical construction of a lacrimal passage.** Arch. of Ophth., 1943, v. 29, April, pp. 575-577.

The author reports the case of a ten-

year-old girl with epiphora of the left eye since birth. Both the upper and lower puncta were absent and dissection demonstrated complete absence of the lacrimal sac, the canaliculus, and other structures of the lacrimal passage. There was an abnormal spur of bone in the lacrimal fossa. An artificial lacrimal passage was produced in an ingenious manner. An incision was made over the lacrimal fossa as for a dacryocystorhinostomy. An opening was made through the bone into the middle fossa. A passage 3 mm. in diameter was then made from the nasal opening to the site where the lower punctum would normally have been. A graft of mucous membrane was taken from the lip and stitched to a hollow 2-mm. rubber catheter. This catheter was inserted into the passage and anchored in such a way that the mucous-membrane graft lined the entire passage. One end of the tube was brought out through the new opening where the lower punctum should have been and the other end was pulled through the nostril. When the rubber tube was removed on the sixth day, the artificial passage had been completely lined by mucous membrane. This passage has remained patent, and after two years it appears to function at least 75 percent as well as a normal tear apparatus. (Illustration.)

John C. Long.

Julianelle, L. A., and James, W. M. **Molluscum contagiosum of the eye, its clinical course and transmissibility, and the cultivability of the virus.** Amer. Jour. Ophth., 1943, v. 26, June, pp. 565-571. (One table, one black and white plate, references.)

Wiener, Alfred. **Simple procedure for relief of entropion.** Arch. of Ophth., 1943, v. 29, April, p. 634.

For those patients in whom operative treatment for entropion is undesirable, the author suggests a method of treatment. This consists in a device so attached to the lower rim of a spectacle frame that slight pressure is exerted on the lid, everting it. The device does not annoy the patient and can hardly be seen. The author reports on its highly successful application in one case. John C. Long.

15

TUMORS

Benedict, W. L., and Parkhill, E. M. **Glioma of the retina in successive generations.** Amer. Jour. Ophth., 1943, v. 26, May, pp. 511-521. (4 case reports, 6 illustrations, extensive bibliography.)

Burch, F. E. **Malignant melanomas of the uvea and their prognosis.** Minnesota Med., 1943, v. 26, Feb., p. 208.

Microscopic extension of tumor cells along emissary vessels and nerves, with macroscopic penetrations of the sclera, were found in 22 instances out of a series of 113 cases. Nevertheless actual recurrence in the orbit has developed in only six cases. The author believes that nature provides some systemic resistance, phagocytic or chemical destruction locally, to prevent metastasis or local recurrence. Since a dosage of radiation which might destroy tumor cells must similarly damage healthy adjacent tissues, the blood supply, and natural resistance, one must expect an unfavorable sequence to the prophylactic use of irradiation.

The author treated two cases with radium, and 35 cases with X-ray irradiation, using 1500 r in divided doses for 15 days. The eyes were not enucleated until a month after irradiation. The dosage was sufficient, since sev-

eral cases showed contraction of orbital tissues. The results are thought to prove definitely that prophylactic radiation therapy is valueless for the purpose of arresting growth, preventing metastasis, or improving the prognosis. R. Grunfeld.

Camp, W. E. **Prognosis of malignant melanomata of the uvea from the standpoint of pathogenesis, cytology, and fiber content.** Minnesota Med., 1943, v. 26, Feb., p. 210.

The author compared the malignancy of the melanomas on the basis of cell types and fiber content. Following-up ninety cases he found that the spindle-cell melanoma had the best prognosis to survive the enucleation for five years; next the mixed cell; then the epithelioid type; and most malignant were the melanomas with fascicular-type cells. These statements compare well with the findings of Callender, the originator of this classification, with the exception that the latter found the epithelioid-cell sarcomas the most malignant.

With a modification of Foot's stain, Camp impregnated the tumors with silver salts to show the argyrophile reticulum. According to Callender and Wilder, most malignant are those tumors which have no fibers among the tumor cells. The prognosis improves in proportion to the increase of fibrous areas in contrast to fiberless areas, and the best prognosis, the least mortality, pertain to those tumors which show fibers among the tumor cells throughout all areas. R. Grunfeld.

Kahler, J. E., Wallace, W. E., Irvine, R., and Irvine, A. R. **Leiomyoma of iris.** Arch. of Ophth., 1943, v. 29, March, pp. 479-484.

Neoplasms of the iris are of infrequent occurrence, and leiomyomas are rare. Furthermore, not all the tumors described as leiomyomas are acceptable as such, since without special stains it is often impossible to differentiate this tumor from non-pigmented melanoma. The authors report a case in a 46-year-old white woman. The tumor appeared to have arisen directly from the dilator pupillae muscle, and therefore to be of epiblastic origin. This case is only the seventh in the literature. None of the cases has shown metastasis, and it is concluded from available reports, and from the present case, that leiomyoma of the iris is a benign tumor and is susceptible to local removal. (4 figures, references.)

Ralph W. Danielson.

Reese, A. B. **Precancerous melanosis and the resulting malignant melanoma (cancerous melanosis) of conjunctiva and skin of lids.** Arch. of Ophth., 1943, v. 29, May, pp. 737-746; also Trans. Amer. Ophth. Soc., 1942, v. 40, p. 224.

Precancerous melanosis is a diffuse, nonelevated pigmentation which has a granular appearance, with sometimes slight loss of luster of the involved conjunctival surface. The average age at which it appears is from forty to fifty years, and the average length of time between its appearance and the malignant change is from five to ten years. An important characteristic is its diffuseness.

Precancerous melanosis may be confused with three conditions. (1) Congenital melanosis of the conjunctiva is a localized area of pigmentation, usually adjacent to the limbus, in an otherwise normal-appearing conjunctiva; it is present from birth or shortly thereafter, undergoes no change

throughout life, and is due to pigment in the basal layer of an otherwise normal conjunctiva. The pigment is black in contrast to the yellowish appearance of precancerous melanosis. (2) Melanosis oculi is an increase in the pigmentation of all the potentially pigment-bearing tissue in and around one eye as compared with the fellow eye. If the conjunctival aspect is particularly pronounced it may be confused with precancerous melanosis, but the dense pigmentation of the entire uveal tract of the involved eye as compared with the fellow eye serves to distinguish the two conditions. (3) Nevus, typically, can be confused with precancerous melanosis only when it is flat, diffuse, and irregularly pigmented. It may then to some degree resemble an area of precancerous melanosis, but the fact that the nevus has been present since earliest recollection and that it is always to some extent elevated, with a rather undulating and irregular surface, should differentiate it. A biopsy would establish the diagnosis decisively. The author states that he has never seen a malignant melanoma of the conjunctiva or skin which could be said with certainty to have arisen from a congenital nevus.

Precancerous melanosis is inevitably a precancerous lesion in the earliest stage, and is radiosensitive in the precancerous stage. The congenital neurogenic nevus in the benign phase is not usually precancerous and is completely radioresistant. As the malignant melanoma arising from acquired melanosis is a different tumor from the malignant melanoma arising from a nevus, it seems advisable to use the term "cancerous melanosis" to designate the type of malignant melanoma arising from acquired precancerous melanosis. The author reports a series of 17 cases, five of which were considered to be in the precancerous stage. (5 photomicrographs, 2 color plates, references.)

Ralph W. Danielson.

Terry, T. L. **Some clinical applications of fluorescence in relation to melanotic pigment.** Amer. Jour. Ophth., 1943, v. 26, May, pp. 536-539. (2 photographs, references.) See Section 1, General methods of diagnosis.)

16

INJURIES

Alvaro, M. E. **Effects other than anti-infectious of sulfonamide compounds on eye.** Arch. of Ophth., 1943, v. 29, April, pp. 615-632; also Trans. Sec. on Ophth., Amer. Med. Assoc., 1942, 93rd mtg. (See Section 6, Cornea and sclera.)

Berens, C., and Hartmann, E. **Effect of war gases and other chemicals on the eyes of the civilian population.** Bull. New York Acad. Med., 1943, v. 19, May, p. 356.

Vesicant, lung-irritating, sternutatory and lacrimatory gases are the ones known and expected by physicians. Physicians have now to reckon with new unknown gases, for instance hemolytic gas which was considered as a possibility in 1939. The immediate treatment of all gas and chemical injuries of the eyes is irrigation of the conjunctival sac with water or sterile salt solution. Immediate instillation of light liquid petrolatum is recommended, but this is contraindicated in mustard-gas burns. Most important is the sterility of the applied solution and instruments, as the principal danger of war gas injuries lies in secondary infections. Such infection should be

treated with a mild silver-protein or sulfadiazine solution or ointment. No ointment should be used in the first few days following mustard burns.

Gertrude S. Hausmann.

Carlisle, J. M., and Gibson, A. **Treatment of burns and foreign bodies of the eye.** Jour. Med. Soc. New Jersey, 1943, v. 40, March, p. 89.

The importance of proper and quick treatment of foreign bodies and burns of the eye is stressed. First-aid instructions should be given. For acid burns, a buffer 2-percent solution of sodium bicarbonate should be instilled until a neutral reaction is found on testing the secretion in the fornices. For alkali burns the buffer solution consists of acetic acid 2.5 gm., sodium acetate 3 gm., sodium chloride 4.5 gm., and distilled water 1,000 c.c. This solution should be instilled every three to five minutes for thirty to fifty minutes, and the reaction of the secretion in the fornices should be tested. For alkaloid burns 3-percent solution of sodium thiosulfate should be instilled every three to five minutes for thirty to fifty minutes. For lime burns a 4-percent solution of ammonium tartrate has been recommended.

Gertrude S. Hausmann.

Harding, Glen F. **Repeated placement of foreign bodies in inferior fornix.** Arch. of Ophth., 1943, v. 29, March, pp. 486-487.

The author reports the case of a 15-year-old girl who had been placing pieces of glass in the inferior fornix of the left eye, so that 16 splinters of such glass were removed at five visits during a period of 22 days. Surprisingly little irritation and no permanent damage were produced. The patient was referred to a psychiatrist. (One illustration.) Ralph W. Danielson.

Rigdon, R. H., Ewing, F., and Tate, A. **Effects of infra-red irradiation on the tissues of the rabbit.** Amer. Jour. Path., 1943, v. 19, May, pp. 517-523.

The pathologic changes that occur in the rabbit following application of infrared radiation to the skin are described. These are characterized by extensive necrosis and ulceration. Lesions are present in the skin, muscles, stomach, intestines, spleen, liver, lungs, brain, bone marrow, and eyes.

In the eyes the epithelial cells of the cornea were frequently found infiltrated with polymorphonuclear leukocytes. The cells in the retina also showed degenerative changes and leukocytes infiltrated the area. The lens frequently appeared opaque in the rabbits that lived for several hours after application of the light. (2 plates.)

T. E. Sanders.

Stallard, H. B. **War surgery of the eye.** Brit. Med. Jour., 1942, Nov. 28, p. 629.

The writer discusses the reasons for removing by the posterior route intraocular magnetic foreign bodies arising from war missiles, and describes the operative technique. Among the advantages of the posterior route are the following: (a) One avoids the damage to the ciliary body, iris and lens which is inevitable in extraction of these large, rough, irregular foreign bodies by the anterior route. The metals which compose the casing of shells, grenades, and mines are either nonmagnetic or of low magnetic quality. In many cases the terminal of the giant magnet has to be placed as near as possible to the foreign body to be effective. (b) In cases in which the foreign body proves nonmagnetic the opening in the sclera may be used for the passage of forceps or a fine wire

snare. (c) There is less postoperative disturbance of the eye than with use of the anterior route.

In summarizing the ophthalmic procedures in the campaign of the Western Desert the interesting statement is made that "the delay of 6 to 14 days in giving appropriate surgical treatment to those wounded during the early phases of the campaign did not seem to have jeopardized the future of the eye." It was difficult to assess the protective value, if any, of the British steel helmet so far as the eyes were concerned. Major Ascroft of the Mobile Neurological Unit prepared a composite photograph based on a radiograph of a soldier's skull when wearing in turn a British and an Italian steel helmet. On this radiograph were marked the sites of 150 penetrating wounds of the skull, of which 65 fell below the level of the British helmet but were covered by the Italian helmet. It seemed likely that the Italian helmet would protect the eyes from metal splinters flying as low as 90° from the vertical on either side. There was a remarkable concentration of wounds about the frontal area.

The author's operative technique is illustrated by two drawings. An important feature in case of scleral wounds either over the posterior part of the pars plana of the ciliary body or between the ora serrata and the equator is one or two applications of surface diathermy, 70 to 80 ma. for five seconds, over the wound so as to extend just beyond its limits. This effects contraction and hardening of the sclera, and incidentally reduces the size of the wound. Its purpose is to produce hemostasis of the sclera and underlying uveal tract and to insure subsequent chorioretinal adhesions where the foreign body tears through these membranes on leaving the eye. Loss of vitreous is minimized by turning the head and eye so that the scleral wound lies uppermost.

The writer concludes with the impressive statement that "to date, vitreous loss has never occurred and the eyes have shown no postoperative exacerbation of inflammation." He describes a simple method of X-ray localization of intraocular fragments in the absence of elaborate apparatus. The method depends upon the position of the foreign body in relation to a silver ring of known diameter fitting exactly the corneoscleral junction and fastened to it by conjunctival sutures. Pictures are taken from various angles. The technique and interpretation of the radiograph are described in minute detail. Jerome B. Thomas.

Town, A. E. **Metal eye protector.** Arch. of Ophth., 1943, v. 29, April, p. 633.

A metal eye protector devised for military purposes is described. It consists of two steel eye cups with cross stenopeic slits. The cups are held together by a cross bar, which can be adjusted to regulate the interpupillary distance. The edge of the cups is surrounded by soft rubber, which fits closely around the eyes. An elastic headband holds the device in place. The protector has little weight and can be folded to carry in the pocket. It reduces the daylight by 84 percent, hence is of value as a sun glass. This device has been adopted by the Russian government. (One illustration.)

John C. Long.

Warren, Shields. **Effects of radiation on normal tissues. 10. The eye.** Arch. of Path., 1943, v. 35, Feb., pp. 304-312.

In this review of the literature re-

garding the effects of radiation on the normal eye, practically all of the material discussed is experimental. The severe destructive action of roentgen rays on the structures of the anterior segment was recognized very early (1897). Although there is little difference in the sensitivity of the tissues of the anterior segment, the conjunctiva reacts first, followed by the cornea and then the iris. These reactions are elicited by smaller doses than are required for a dermatitis and the latent period is shortened. The lesions noted are usually mucopurulent conjunctivitis, interstitial keratitis, and atrophy of the iris with slight iritis. The adult animal lens is very resistant to radiation, but in the lens of the embryo or young animal lenticular opacities are usually produced. The posterior segment is rarely involved. (Bibliography.)

T. E. Sanders.

17

SYSTEMIC DISEASES AND PARASITES

Fite, S. L. **Leprosy from the histologic point of view.** Arch. of Path., 1943, v. 35, April, pp. 611-644.

In a general review of the microscopic lesions of leprosy as found in the various organs, a short discussion of the eye lesions is included. Direct extension of the leprous lesions of the skin to the conjunctiva and then to the cornea is probably the most important mechanism in ocular involvement. Keratitis punctata superficialis leprosa depends on spread of the bacilli between the lamellae, the bacilli being chiefly intracellular. In spite of localized infiltrations the cornea tends to remain avascular.

The bacilli may pass along the ciliary nerves to the ciliary body and iris, although these tissues may also be involved through hemotogenous spread. The lesions in the anterior uveal tract tend to become granulomatous. Any involvement of the posterior segment is very rare.

T. E. Sanders.

Gifford, S. R., and Konné, M. **Filaria loa removed from upper lid.** Arch. of Ophth., 1943, v. 29, April, pp. 578-582.

One of the authors (M. K.) had lived in Equatorial Africa in an area heavily infested with filaria loa. In 1936 he had shown an eosinophile count of 12 to 16 percent, but not until 1938 did he develop clinical signs of infestation, consisting of transient swelling of one arm. In April, 1940, in Chicago, a worm was seen moving beneath the bulbar conjunctiva. This was observed for about eight hours, after which the parasite disappeared. On many occasions thereafter tender swellings were noted in various parts of the body. In May, 1942, the worm could be seen moving beneath the skin of the right upper lid. After injecting 4 percent procaine solution to inactivate the worm and then fixing it with a suture, the skin was incised and the parasite grasped and removed. The worm was of the size of a piece of surgical catgut and about 3 cm. long. It was identified as an adult female filaria loa. The lid became quite swollen from the liberation of toxic material from the worm. This condition subsided in two days. Swelling has since appeared in other localities, indicating the presence of another parasite. No microfilaria were found at any time, demonstrating that the parasites were all female hence incapable of reproducing within the host. Other worm infestations are discussed. (3 illustrations, references.)

John C. Long.

Haessler, F. H. **Tuberculosis of the eye.** Minnesota Med., 1943, v. 26, Feb., p. 161.

A review of the clinical manifestations of tuberculosis of the eye, and the present status of immunology and therapy. R. Grunfeld.

Kodicek, J. H., and Yudkin, J. **Slit-lamp microscope in nutrition surveys.** The Lancet, 1942, v. 143, Dec. 26, p. 753. (See Section 6, Cornea and sclera.)

Larkin, B. J. **The ocular manifestations of multiple sclerosis.** Jour. Indiana State Med. Assoc., 1943, v. 36, Jan., p. 26.

The ocular manifestations of multiple sclerosis discussed are retrobulbar neuritis, diplopia, nystagmus, abnormal pupillary reactions, optic atrophy, papillitis, and papilledema.

J. Wesley McKinney.

Livingston, P. C., and Bolton, B. **Night visual capacity of psychological cases.** The Lancet, 1943, v. 244, Feb., 27, p. 263.

The processes concerned in dark adaptation, or more broadly night visual-capacity, are known to vary from time to time in healthy individuals. There is little doubt that some of the responses elicited during research into nutritional conditions as they affect the visual threshold can be explained as individual variations.

A study of the night visual-capacity of inpatients of an eye, ear, nose, and throat hospital suggests that the apparent inconsistency of some of the visual results obtained from examination of the visual threshold in dietetically deficient subjects may in part be due to varying attitudes of mind. Fifty psychologic cases were studied and compared with fifty normals. The psychologic states were mainly anxiety (with or without complaint of night blindness), depression, and hysteria. The psychologic cases recorded a definitely lower score than the normals. It is suggested that some of the variations in night visual-capacity in healthy people may depend on lesser degrees of difference in mental makeup.

J. Wesley McKinney.

Loomis, G. L. **Ocular manifestations of some constitutional disturbances.** Minnesota Med., 1942, v. 25, Oct., p. 797.

The diagnostic importance of sudden visual changes and contraction of visual fields is discussed. Five cases are reported, three of them alcohol and tobacco amblyopias, one myasthenia gravis, one diabetes not previously discovered. In all these cases the diagnosis had been missed at first because only a routine refraction test had been made.

Gertrude S. Hausmann.

Lurie, L. A., and Levy, S. **Laurence-Moon-Biedl syndrome.** Jour. Pediatrics, 1942, v. 21, Dec., p. 793.

Two cases of "incomplete" Laurence-Moon-Biedl syndrome are discussed. The authors contend that this so-called syndrome is only one of many forms of heredofamilial deviation. Among the most frequent hereditary symptoms are retinitis pigmentosa, obesity, hypogenitalism, mental retardation, and polydactylism. The two cases reported show deafness of nerve type. The electroencephalographic findings as well as the results of the androgen, audiometer, and developmental tests are reported for the first time in relation to this condition.

Gertrude S. Hausmann.

McDermott, W., Webster, B., Baker, R., Lockhart, J., and Tompsett, R. **Nutritional degeneration of the optic nerve in rats; its relation to tryparsamide amblyopia.** Jour. Pharmacology and Exper. Therapeutics, 1943, v. 77, Jan., p. 24. (See Section 11, Optic nerve and toxic amblyopias.)

Petersen, W. F. **Weather and ocular pathophysiology.** Arch. of Ophth., 1943, v. 29, May, pp. 747-759.

In recent years Duggan has been proposing the idea that much ocular disease is directly or indirectly produced by vascular dysfunction and that this in turn can be precipitated by changes in the weather. Changes in the weather involve a fundamental difference in the air mass in which human beings exist. Polar air is diametrically opposite to tropical air in its character and in its demands on the human organism. The former is heavy, cold, clear, and dry. The organism seeks to shut itself off from the unfavorable effects of the cold by a sympathicotonic phase, with increased arteriolar tone, sugar mobilization, and relative alkalinity. Tissues, especially peripheral tissues become relatively anoxic. The tissue status is reversed when the metabolic products of anoxia begin to enter the circulation; the organism is then stimulated or may go on to fatigue. Tropical air is warm, moist, and lighter in weight, and its effects are opposite to those of polar air.

This paper includes a study of the relation of weather to a series of 13 cases of iritis, iridocyclitis, episcleritis, choroiditis, and retrobulbar neuritis, associated with multiple sclerosis. The author concludes that any extreme in the environmental situation, whether toward cold or undue heat, is apt to find reflection in clinical symptoms. While any of the environmental factors—for example, trauma, sensitization, emotion, infection—may act as a precipitating force, the weather episode is the most common of the energy impacts that are effective, for the biologic effect is apt to be prolonged. (14 meteorograms, references.)

Ralph W. Danielson.

Rosner, A. A. **Unit reaction states in oculogyric crises.** Amer. Jour. Psychiatry, 1942, v. 99, Sept., p. 224.

The oculogyric crisis in epidemic encephalitis is characterized by recurrent episodes of concomitant ocular fixation during which the eyes are turned upward or laterally. It is considered a paracortical disturbance in which the disorder of motility retains its functional relationship to the total cortical organ. Although the normal cortical activity in other spheres is abolished, large segments of the cortical association system are preserved functionally intact. Abnormal psychiatric patterns are associated with the oculogyric crises. These patterns retain their identity from spell to spell, representing dissociated psychophysiologic entities capable of reactivation as unit structures. For this reason they may be called unit reaction states.

R. Grunfeld.

Thygeson, Phillips. **Viruses and virus diseases of eye. 2. Viruses of ocular importance.** Arch. of Ophth., 1943, v. 29, March, pp. 488-508, and April, pp. 635-661.

This is the second paper of a series on the subject, published as an ophthalmic review of the literature by an author who has himself done considerable work on the problem. Thygeson introduces this second paper by stating that the eye is subject to major or

minor involvement in many of the known virus diseases. The viruses of inclusion blennorrhea, herpes simplex, and herpes zoster have their most important localization in the eye, whereas the viruses of variola, vaccinia, and lymphogranuloma venereum only rarely affect the eye. A large number have minor ocular localizations; among these being the viruses of psittacosis, dengue fever, foot and mouth disease, rabies, lymphocytic choriomeningitis, and canine distemper. It is quite conceivable that other vague eye conditions may be due to viruses.

A most instructive diagram depicts the selective major and minor localization of the various viruses in the different parts of the eyeball. The author discusses the cultural properties of the viruses, and ocular effects, in variola and vaccinia, herpes simplex, herpes zoster, molluscum contagiosum, common wart, measles, lymphogranuloma venereum, trachoma, inclusion conjunctivitis, foot and mouth disease, mumps, dengue fever, sandfly fever, louping ill, and other diseases. Ocular diseases of suspected virus causation are: acute follicular conjunctivitis of Beal, chronic follicular conjunctivitis, ocular pemphigus, dermatitis herpetiformis, superficial punctate keratitis, epidemic and other types of keratoconjunctivitis, chronic catarrhal conjunctivitis, and erythema multiforme. Animal examples of virus diseases with ocular manifestations are periodic ophthalmia of horses, infectious myxomatosis of rabbits, and canine distemper. A table is given showing the confirmatory laboratory procedures for suspected cases. (Extensive bibliography, one diagram, 9 photomicrographs, and drawings.) Ralph W. Danielson.

Verma, O. P. **Partial degeneration of the optic nerve associated with vitamin deficiency.** Indian Med. Gazette, 1942, v. 77, Nov., p. 646. (See Section 11, Optic nerve and toxic amblyopias.)

Wright, R. E. **Deficiency disease and academic evidences of subnormal vitamin metabolism.** Brit. Med. Jour., 1942, Dec. 19, p. 723.

The war with its food-restriction and black-out conditions has focused attention on vitamins until the public and medical profession have become almost hysterically vitamin-minded. This state of affairs is largely due to the premature booming of experimental observations. The clinician uses vitamins for many affections and acclaims their value by post-hoc arguments. The writer calls attention to the advantages of the study of vitamin deficiency in great areas such as China, Russia, and India, where the manifestations are extensive and indeed constitute a familiar everyday problem.

Night-blindness is the only subjective symptom of vitamin-A deficiency until the later stages of the disease syndrome. Frankly predominant vitamin-A deficiency is common in India in the Madras Presidency, with a population greater than that of England and Wales. Its manifestations differ in children and adults and the writer has long urged that it is the greatest cause of blindness in South India, on account of the associated keratomalacia. The latter term is commonly used throughout the Far East for the whole syndrome, which emphasizes the importance of this complication. The commonest and perhaps earliest sign is smokiness of the conjunctiva. Formerly the writer considered hemeralopia the earliest. This conjunctival sign is well recognized in China but not in Britain. It is also called "phrynoderma" by certain writers and is reported

as present in 14 percent of the children of the poor in certain groups of South India. Either this sign or hemeralopia may be absent in cases which are otherwise clinical examples of frankly predominant vitamin-A deficiency. "That fact is enough in itself to show what a false emphasis has been placed on the connection between vitamin-A metabolism and variations in night vision here (Britain) since the war began." In discussing photometric methods the author quotes with approval Jung's remark (1938) that a more critical evaluation of the results of photometric testing is required before final conclusions can be drawn on either the incidence of subclinical forms of vitamin-A deficiency or the effect of therapeutic measures on the results of such tests. The application of Jung's ideas on poor dark-adaptation to recent work in Britain would in Wright's opinion show that in "conditions influenced by so many uncontrolled variables the readings are completely determined by chance." In South India night blindness does not constitute a labor problem nor interfere with night work to any extent.

In considering the subject of night vision in the Army the author divides poor dark-adaptation into three types: (1) Psychologic disturbances, which are a frequent and serious cause of poor night vision. This form of psychoneurosis has received a considerable impetus from the publicity campaign concerning the benefits of vitamin A in night vision. The evil effects of the campaign are enormous and the term night blindness has attained a suggestion value analogous to that of "shell-shock" in the last war. (2) The pathogenic type due to well known pathologic ocular conditions. (3) The physiologic group in which the poor night vision may be regarded as a variation in dark-adaptation at one end of the physiologic curve. This function is influenced by many factors, both individual and racial. It is not a vitamin-A problem and will not be solved by "following the carrot."

Criticism is likewise applicable to recent activities in connection with vitamins B-complex and C. To attempt to assess B_2 deficiency mainly by means of minor variations in the capillary loops at the corneal margin (Sydenstricker and others, 1940) is futile in wartime. The processes of biologic oxidation with which the vitamins are eventually concerned are interdependent and overlap, just as the clinical evidences of deficiency overlap. This fact leads to important abstruse fields of chemical inquiry. Such investigations and mass biochemical observations, especially in children, will doubtless afford information which may be of use in postwar reconstruction. (16 references). Jerome B. Thomas.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Alvaro, M. E. **Aspects of Brazilian ophthalmology.** Amer. Jour. Ophth., 1943, v. 26, May, pp. 474-479.

Berinstein, Benjamin. **Employment for the blind.** Outlook for the Blind, 1943, v. 37, Jan., p. 17.

Estimates in percentages of employable blind persons are said to vary between five and forty. Since no factual material has been found to support any of these estimates, the author, in his article, confining himself to cases whose visual acuity does not exceed 20/200 with correcting lenses (proper consideration being given to field defects), attempts to arrive at sensible

definitions of terms involved in such a discussion. F. M. Crage.

Burch, E. P. **Refraction procedures in the military service.** The Military Surgeon, 1943, v. 92, March, p. 300. (See Section 3, Physiologic optics, refraction, and color vision.)

Byrnes, V. A. **Eye problems in combat aviation.** Texas State Jour. Med., 1942, v. 38, Oct., p. 399.

One of the biggest problems in combat aviation is night vision. The cones do not function in light of slightly less intensity than of moonlight. They reach their maximum sensitivity to low illumination in six to eight minutes after exposure to bright light. The rods require about thirty minutes to become dark-adapted. Dark adaptation is an independent process in each eye; thus the pilot should close one eye if exposure to light becomes unavoidable. In locating objects at night, central fixation should be avoided, so that the image may fall on the more sensitive rods. Red light should be used for illuminating instrument panels, because dark adaptation is not lost under red light. Blue light can be seen ten times as far as red light of the same intensity. It is essential that oxygen be used at all altitudes over 5,000 feet, as oxygen deprivation produces a decreased retinal sensitivity to low illumination. The necessity of a diet adequate in vitamin A is stressed for flying personnel. The importance of the form and the shade of the goggles is pointed out.

Gertrude S. Hausmann.

Chance, Burton. **Bishop Berkeley and his use of tar water.** Annals of Med. History, 1942, v. 4, Nov., p. 453.

In January, 1729, George Berkeley, Dean of Derry, of the Church in Ireland, writer on economics, wit and poet, mathematician, and benevolent friend and would-be healer of the sick, landed at Newport, Rhode Island. His philosophic ideas caused a stir in the scientific world and he later roused the medical world of England by his advocacy of a panacea called "tar water." In a philosophic book, "Siris, a chain of philosophic reflections and inquiries concerning the virtues of tar water," he gives the method of preparation and the different uses of tar water. "In certain parts of America, tar water is made by putting a quart of cold water to a quart of tar, and stirring them well together in a vessel, which is left standing till the tar sinks to the bottom." The clear water was used for smallpox, purulent ulcerations, stomach derangements, various inflammatory processes, pulmonary disorders, bloody fluxes, gout, renal disorders, and scurvy. The uses of tar water soon became widely known in Europe.

Gertrude S. Hausmann.

Chance, Burton. **George Berkeley and "An essay towards a new theory of vision."** Arch. of Ophth., 1943, v. 29, April, pp. 605-614; also Trans. Amer. Ophth. Soc., 1942, v. 40, p. 43.

George Berkeley, a native of Ireland, was a great thinker. "He came forth the most subtle and accomplished philosopher of his time, almost from darkness." Before the age of 25 years he published an essay on vision. The design of the essay was "to show the manner wherein we perceive by sight the distance, magnitude, and situation of objects. Also to consider the difference there is betwixt the ideas of sight and touch, and whether there be any idea common to both senses." Berkeley made no observations of the optical

and physiologic phenomena. The "essay" is strictly a contribution to psychologic analysis of the facts of vision and not a deduction from physical experiments in optics or physiology.

John C. Long.

Dvorak, J. E. **Office procedures in ophthalmology.** Jour. Iowa State Med. Soc., 1943, v. 33, Feb., p. 53.

This paper is a detailing of many office procedures and does not lend itself to abstracting.

Ferree, C. E., and Rand, G. **Eye as a factor in wartime lighting.** Arch. of Ophth., 1943, v. 29, March, pp. 461-478.

There are two aspects of wartime lighting: lighting for efficiency in industry and lighting for protection of the factory, hospital, and home. The chief interest in lighting for efficiency will probably be in industrial lighting to increase the speed of production. In general, well-diffused light should be used. There are some instances in local lighting, however, in which a higher visibility of the work is given by light that is not diffused, for example in the reading of a vernier scale on metal and in the detection of scratches or flaws on the surface of metals.

In most lighting the best results can be obtained by providing evenly distributed well-diffused light with complete elimination of glare and high brightness from the field of view and by supplementing this with local lighting where it is needed. A most important aspect of good lighting, particularly where high intensities are used, is the elimination of glare on the work. Three important factors in glare are color of light, diffuseness of light, and direction or angle at which it falls on the work. The authors have devised a light to fulfil these requirements.

Fluorescent or tube lighting as well as incandescent lighting will probably be used in many plants. Points to be considered are the color and composition of the light and the lighting fixture. In general it may be said that tests of effect on welfare and comfort of the eye, such as have been made for incandescent lighting, have not yet been made for fluorescent lighting. Tests have shown, however, that it is not safe to tinker with the color and composition of light without an adequate checking up of its effect on the eye. The eye has developed under daylight, and it has been abundantly shown by use and by test that daylight is the best for it. If there is to be any deviation, the eye is more comfortable with light deviating toward yellow and orange than toward the green and blue. Fixtures for the fluorescent tube are as yet in a crude stage of development. In the preparation for war more stress is being laid on mechanical equipment than on conservation of manpower.

Discussing color and composition of light in relation to the blackout, Ferree and Rand point out that dark blue is the least distinguishable from dark gray and black of any of the shades of color, and that, by suitable regulation of intensity and hue, illumination of an interior with blue light can be given a dim moonlight effect which differs little in color from the exterior illumination on a moonlight night.

As for black-out lighting in the home, the authors point out the defects of the ordinary black-out devices as a year-round means of securing a complete black-out. In Southern cities, maintaining complete blackout in a fully lighted room on a hot summer night for any considerable length of time by means of curtaining or similar devices alone

is impracticable. Light-proofing of rooms without some form of air conditioning seems to Ferree and Rand not worthy of serious consideration for hot seasons of the year. (4 figures, references.) Ralph W. Danielson.

Grossmann, E. E. **The relationship of the eye to antiaircraft gunnery.** The Military Surgeon, 1943, v. 92, April, p. 383.

In selecting those most suited for antiaircraft gunnery 779 soldiers were examined. The following requirements were thought desirable for efficient performance of the gun crew: The vision should be 20/20 or better, and one eye should not have more than one diopter difference in refraction from the other. The convergence angle should not be less than forty degrees. The depth perception should not be persistently more than thirty degrees separation of the rods on the Howard-Dolman apparatus. The color perception should be normal or only slightly deficient. The eyes should be free from lid infection and from abnormal sensitivity to glare and to wind. The muscle balance should be within the following limits: esophoria 12, exophoria 8, hyperphoria 0.5.

Gertrude S. Hausmann.

Hayes, S. P. **A second test scale for the mental measurement of the visually handicapped.** Outlook for the Blind, 1943, v. 37, Feb., p. 37.

This scale is an adaptation of the Terman-Merrill revision of the Stanford-Binet tests for examination of blind students. Since many items in the standard test require vision, other items were included instead. The adapted scale shows high correlation with other measurements of the same students. R. Grunfeld.

Mihalyhegyi, G. **The significance of reduction of visual acuity for industrial efficiency and choice of occupation.** Ophthalmologica, 1942, v. 104, Oct., p. 185.

A general discussion of the problem, in which the author points out the difficulty of establishing absolute criteria for evaluation of the part played by visual acuity in industrial efficiency. He submits a classification of occupations into ten groups on the basis of their minimum visual requirements: those occupations requiring 5/5, 5/6, 5/8 and so on, to 5/50 and less. The judgments as to visual requirement of a particular occupation are said to be based on practical experience, but the author does not describe the nature of that experience.

Each of the ten groups is also given an arbitrary number which is to be used in evaluation of industrial loss. The number is intended to be added to the percentage loss as calculated on the basis of tables by Maschke. It is the author's opinion that the end result gives a fairer estimate.

F. Herbert Haessler.

Mundt, G. H. **An analysis of the vision of 200 consecutive selectees as seen by an advisory-board oculist.** Illinois Med. Jour., 1942, v. 82, Nov., p. 347.

Of two hundred selectees with defective vision over a half were myopic. The author suggests that the general public be educated to the effect that the myope ought to keep under the constant supervision of an oculist. 26.5 percent had vision of 20/100 correctable to 20/40 in each eye. The vision of 67.5 percent was 20/400 correctable to 20/40 in one eye, and 6 percent had vision less than this.

Not one malingerer was found among the two hundred. R. Grunfeld.

Palmer, E. L. **The blind youth and his future.** Outlook for the Blind, 1943, v. 37, Feb., p. 31.

Since blind people gained access to and held successfully jobs in industry during the war emergency, there is hope that they will retain their rightful place in the work of the world. The education of the blind must be altered accordingly, to widen their gainful participation in industry. It will be necessary to study the types of factories in the community and the possibility of placing blind workers in them, and also to train the visually handicapped for the types of job for which their particular qualifications fit them.

R. Grunfeld.

Regan, J. J. **Walter B. Lancaster. A biographical sketch and bibliography 1897-1943.** Amer. Jour. Ophth., 1943, v. 26, May, pp. 445-453. (One photograph.)

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Bender, M. B., and Weinstein, E. A. **Functional representation in the oculomotor and trochlear nuclei.** Arch. Neurology and Psychiatry, 1943, v. 49, Jan., p. 98.

With the aid of the Horsley-Clarke stereotaxic instrument and weak current the authors stimulated in monkeys the regions of the oculomotor nuclei and nerve roots. They also observed the defective movements following lesions made in these regions by direct current. From their studies it seems to the authors that the following is the arrangement of the functional representation of the ocular muscles in the oculomotor and trochlear nuclei, proceeding from dorsoventral to rostrocaudal: sphincter pupillae (bilateral innervation), inferior rectus, ciliary muscle (bulging of the iris forward), inferior oblique, internal rectus, levator palpebrae superioris, superior oblique (with contralateral innervation).

R. Grunfeld.

Bliss, A. F. **Derived photosensitive pigments from invertebrate eyes.** Jour. of Gen. Physiology, 1943, v. 26, March 20, p. 361.

A study of the photosensitivity of the red pigments of the eyes of squid, blue crab, and horseshoe crab.

J. Wesley McKinney.

NEWS ITEMS

Edited by Dr. Donald J. Lyle
904 Carew Tower, Cincinnati

New items should reach the editor by the twelfth of the month

Deaths

Dr. Stanley W. Blazejewski, Wilkes-Barre, Pennsylvania, died April 12, 1943, aged 63 years.

Dr. Arthur Henry Geiger, Chicago, Illinois, died May 12, 1943, aged 65 years.

Dr. John A. Colgan, Philadelphia, Pennsylvania, died February 16, 1943, aged 66 years.

Dr. William Hansell, Ottumwa, Iowa, died April 6, 1943, aged 88 years.

Dr. William T. Henry, Springfield, Tennessee, died April 17, 1943, aged 85 years.

Dr. Edgar M. Hewish, Philadelphia, Pennsylvania, died April 11, 1943, aged 84 years.

Dr. John J. Randall, Wynantskill, New York, died April 29, 1943, aged 51 years.

Dr. Clifford Black Walker, Los Angeles, California, died July 3, 1943, aged 59 years.

Miscellaneous

It has been announced by the National Society for the Prevention of Blindness that a prize of $250 will be awarded for the most original paper adding to the present knowledge about medical treatment of noncongestive glaucoma. Papers should be in the office of the Society, 1790 Broadway, New York City, by September, 1944. This prize is offered in addition to one that was previously announced for the most valuable original paper concerning the diagnosis of early glaucoma.

Papers may be presented by any practicing ophthalmologist of the Western Hemisphere and may be written in English, French, German, Italian, Spanish, or Portuguese, but those written in any of the last four languages should be accompanied by a translation in English.

The award will be made by the Society with the guidance of an ophthalmologic committee composed of Drs. Evans, Keil, Kirby, McLean, Reese, Samuels, Schlivek, Schoenberg, and Webster.

The Department of Ophthalmology, New York University College of Medicine, has announced that the nine-month graduate course in ophthalmology will be discontinued for the duration of the war because of the educational program associated with the war effort.

The Chicago Eye, Ear, Nose, and Throat Hospital held a series of refresher courses in Ocular Tests from July 25th to 30th, inclusive. The courses consisted of objective testing, retinoscopy, and subjective ocular tests.

The Eye and Ear Research Fund, Inc., announces a two-day course in practical gonioscopy which will be given at the Illinois Eye and Ear Infirmary following the meeting of the American Academy of Ophthalmology and Otolaryngology. The course will begin on Thursday, October 14th, at 9:00 a.m. and finish on Friday, October 15th, at 5:00 p.m. Applications and requests for particulars should be addressed to the Dean of Instruction, 904 West Adams Street, Chicago, Illinois.

Societies

From Lt. Col. Derrick T. Vail (London) we have the following notice of a newly formed association:

"The ophthalmic medical officers of this theatre have formed an association known as the E. T. O. Eye Club. Major Don Marshall is president; Capt. Eugene Anthony, editor of the bulletin that will be published from time to time; and Capt. C. E. McKee is secretary-treasurer. Honorable member, Brig. Sir Stewart Duke-Elder, myself as a purely advisory official. The first scientific meeting will be held at the 2d General Hospital on July 10th." A later communication announces that at the first meeting the guest speaker was Lt. Comdr. E. B. Dunphy, of Boston; his subject, "Ocular injuries of gas warfare." About 30 medical officers were present.

The annual convention of the Association of Military Surgeons of the United States will be held in Philadelphia, October 21st-23d, inclusive. Physicians attending this convention will be given an opportunity to study Army and Navy treatment of casualties at two of the nation's leading military hospitals. Inquiries should be addressed to Capt. J. A. Biello (MC), U.S.N., at the Navy Yard, Philadelphia.

The sixty-fifth annual session of the Medical Association of Montana was held July 7th and 8th, with Dr. William M. Bane, Denver, among the guest speakers. The title of his paper was "Treatment of eye diseases by the general practitioner."

The newly-elected officers of The American Ophthalmological Society for 1943-44 are: Dr. John Green, Saint Louis, president; Dr. S. Judd

Beach, Portland, Maine, vice-president; and Dr. Walter S. Atkinson, Watertown, New York, secretary-treasurer.

The Reading Eye, Ear, Nose, and Throat Society held its twenty-third meeting, June 16, 1943. The speaker was Dr. Edmund B. Spaeth, Philadelphia, who lectured on "Some facts of importance in the nonsurgical treatment of convergent squint."

The following officers were elected for the fiscal year, 1943-44: Dr. R. M. Brickbauer, president; Dr. Solon L. Rhode, first vice-president; Dr. Michael J. Penta, second vice-president; Dr. Paul C. Craig, secretary; and Dr. Arthur A. Bobb, treasurer.

The Southern Medical Association will hold its thirty-seventh annual meeting in Cincinnati, November 16, 17, 18, 1943. The following are officers of the Section on Ophthalmology and Otolaryngology: Dr. John H. Burleson, chairman; Dr. W. Raymond McKenzie, chairman-elect; Dr. Elbyrne G. Gill, vice-chairman; and Dr. J. W. Jervey, Jr., secretary.

The ninth annual meeting of the Mississippi Valley Medical Society will be held in Quincy, Illinois, September 29th and 30th. Among the guest speakers will be Dr. Andrew W. McAlester, Jr., Kansas City, Missouri.

The North Dakota Academy of Ophthalmology and Oto-Laryngology held its twenty-fifth annual session in Bismarck, May 10th. Dr. Tracy W. Buckingham was elected president and Dr. Frederick L. Wicks was elected secretary. The program included the following speakers: Dr. William L. Benedict, Rochester, Minnesota, who spoke on "A critical review of the recent proposed treatments of eye diseases," and Dr. William T. Peyton, Minneapolis, who presented a paper entitled "Brain abscess."

Personals

Dr. Conrad Berens has been appointed civilian consultant in ophthalmology to the Office of the Air Surgeon, according to an announcement by the War Department. Since 1939, Dr. Berens has served on the committee to select and train civilian pilots.

Lt. Col. Derrick T. Vail has accepted membership on the advisory committee of the National Society for the Prevention of Blindness.

Capt. F. P. Calhoun, of Atlanta, Georgia, has recently successfully passed the examinations for and has obtained the diploma in ophthalmology from Oxford (Eng.) University.

A number of U. S. Ophthalmic Medical Officers stationed in Great Britain attended the recent meeting of the Oxford Ophthalmological Congress.